



National Aeronautics and  
Space Administration

NASA CR-

160251

Lyndon B. Johnson Space Center  
Houston, Texas 77058

JSC-14812

JUN 18 1979

PRELIMINARY

TREND MONITORING SYSTEM

DATA MANAGER'S GUIDE

(NASA-CR-160251) PRELIMINARY TREND  
MONITORING SYSTEM DATA MANAGER'S GUIDE  
Final Report (Computer Sciences Corp.,  
Houston, Tex.) - 91 p HC A05/ME A01 CSCL 22B

N79-27232

Unclas  
G3/16 27966

Prepared By

Computer Sciences Corporation  
Applied Technology Division  
Houston, Texas

Under Contract NAS 9-15700

For

INSTITUTIONAL DATA SYSTEMS DIVISION

May 1979

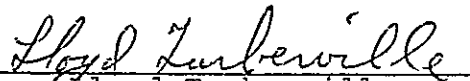


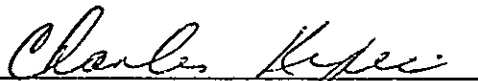
1. Report No. JSC-14812		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Preliminary Trend Monitoring System Data Manager's Guide				5. Report Date May 1979	
				6. Performing Organization Code IDSD/FD7	
7. Author(s) Lloyd Turberville, Don McCormick				8. Performing Organization Report No. CSC-0286	
9. Performing Organization Name and Address Computer Sciences Corporation 1300 Bay Area Boulevard Houston, Texas 77058				10. Work Unit No. <del>88-248</del>	
				11. Contract or Grant No. NAS 9-15700	
12. Sponsoring Agency Name and Address NASA Lyndon B. Johnson Space Center Houston, Texas 77058 Technical Monitor: Charles Krpec				13. Type of Report and Period Covered Final Documentation	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract  The Trend Monitoring System (TMS) has been built to support the near-real time data requirements of the thermal analysis section during a Shuttle flight. The TMS contains a large mini-computer host with six interactive graphic terminals.  The Data Manager's Guide documents the functions and data base structures that the data base manager will be responsible for maintaining. This document contains all normal and error sequences.					
17. Key Words (Suggested by Author(s))  Data Base Management				18. Distribution Statement  Unclassified - Unlimited	
19. Security Classif. (of this report)		20. Security Classif. (of this page)		21. No. of Pages	
				22. Price*	

PRELIMINARY

TREND MONITORING SYSTEM

DATA MANAGER'S GUIDE

  
Lloyd Turberville  
Application Manager

  
Charles Krpec  
Project Leader

  
Art Hambleton  
ODRC Manager

Prepared By  
Computer Sciences Corporation  
for  
Institutional Data Systems Division

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION  
LYNDON B. JOHNSON SPACE CENTER  
HOUSTON, TEXAS

May 1979

## CONTENTS

Section	Page
1.0 <u>INTRODUCTION</u> . . . . .	1-1
1.1 PURPOSE. . . . .	1-1
1.2 SYSTEM OVERVIEW. . . . .	1-1
1.3 DATA MANAGER'S FUNCTION. . . . .	1-2
1.4 DATA MANAGER'S INTERFACES. . . . .	1-2
1.5 SYSTEM DATA BASES. . . . .	1-3
1.5.1 <u>Measurement/Stimulus Identification</u> <u>Data Base</u> . . . . .	1-3
1.5.2 <u>Support Tables Data Base</u> . . . . .	1-3
1.5.3 <u>Calibration Data Base</u> . . . . .	1-3
1.5.4 <u>High-Rate Load Groups Data Base</u> . . . . .	1-5
1.5.5 <u>Display Format Data Base</u> . . . . .	1-5
1.5.6 <u>Predicted Mission Data Base</u> . . . . .	1-5
1.5.7 <u>Past Mission Data Base</u> . . . . .	1-5
1.5.8 <u>Current Mission Data Directory</u> . . . . .	1-5
1.5.9 <u>Current Mission Low/Medium Rate</u> <u>Data Base</u> . . . . .	1-6
1.5.10 <u>Current Mission High-Rate Data Base</u> . . . . .	1-6
1.5.11 <u>Working File Data Base</u> . . . . .	1-6
1.6 SYSTEM DATA FLOW . . . . .	1-6
2.0 <u>TMS DATA BASE MANAGEMENT FUNCTIONS</u> . . . . .	2-1
2.1 LOADING MSID DATA BASE . . . . .	2-1
2.1.1 <u>Input</u> . . . . .	2-1
2.1.2 <u>Output</u> . . . . .	2-2
2.1.3 <u>Informational/Error Messages</u> . . . . .	2-3

Section		Page
2.2	LOADING HIGH-RATE LOAD GROUPS. . . . .	2-4
2.2.1	<u>Input</u> . . . . .	2-4
2.2.2	<u>Output</u> . . . . .	2-5
2.2.3	<u>Informational/Error Messages</u> . . . . .	2-5
2.3	LOADING PREDEFINED DISPLAY FORMATS . . . . .	2-7
2.3.1	<u>Input</u> . . . . .	2-7
2.3.2	<u>Output</u> . . . . .	2-9
2.3.3	<u>Informational/Error Messages</u> . . . . .	2-9
2.4	BUILDING SUPPORT TABLES. . . . .	2-11
2.4.1	<u>Input</u> . . . . .	2-11
2.4.2	<u>Output</u> . . . . .	2-12
2.4.3	<u>Diagnostic Error Messages</u> . . . . .	2-19
2.5	BUILDING CALIBRATION DATA BASE . . . . .	2-21
2.5.1	<u>CDB CYBER 74 Processing</u> . . . . .	2-22
2.5.2	<u>CDB MODCOMP 4 Processing</u> . . . . .	2-30
2.6	LOADING PREDICTED/PAST MISSION DATA BASE . . . . .	2-34
2.6.1	<u>Conversion of Predicted Mission Data</u> . . . . .	2-34
2.6.2	<u>Input</u> . . . . .	2-34
2.6.3	<u>Output</u> . . . . .	2-35
2.6.4	<u>Informational/Error Messages</u> . . . . .	2-35
2.7	INITIALIZATION OF TIMES AND CURRENT MISSION DATA BASES . . . . .	2-38
2.7.1	<u>Input</u> . . . . .	2-38
2.7.2	<u>Output</u> . . . . .	2-39
2.7.3	<u>Informational/Error Messages</u> . . . . .	2-40
2.8	PROCESSING NIP/STCS DATA . . . . .	2-41

Section	Page
2.8.1 <u>NIP/STCS Tape Processing</u> . . . . .	2-41
2.8.2 <u>Reload for High-Rate Data</u> . . . . .	2-46
2.8.3 <u>Restore Intermediate Data</u> . . . . .	2-47
2.9 UPDATING LOW/MEDIUM RATE DATA BASE AND DATA DIRECTORY. . . . .	2-49
2.9.1 <u>Input</u> . . . . .	2-49
2.9.2 <u>Processing</u> . . . . .	2-49
2.9.3 <u>Output</u> . . . . .	2-50
2.9.4 <u>Informational/Error Messages</u> . . . . .	2-50
2.10 UPDATING CURRENT MISSION HIGH-RATE DATA BASE . .	2-52
2.10.1 <u>Input</u> . . . . .	2-52
2.10.2 <u>Output</u> . . . . .	2-53
2.10.3 <u>Informational/Error Messages</u> . . . . .	2-53
2.11 SAVING OF DYNAMIC DATA BASES . . . . .	2-55
2.11.1 <u>Input</u> . . . . .	2-55
2.11.2 <u>Output</u> . . . . .	2-56
2.11.3 <u>Informational/Error Messages</u> . . . . .	2-56
2.12 RELOADING OF DYNAMIC DATA BASES. . . . .	2-57
2.12.1 <u>Input</u> . . . . .	2-57
2.12.2 <u>Output</u> . . . . .	2-57
2.12.3 <u>Informational/Error Messages</u> . . . . .#.	2-57
2.13 SLIDING OF CURRENT MISSION LOW/MEDIUM RATE DATA.	2-60
2.13.1 <u>Input</u> . . . . .	2-60
2.13.2 <u>Output</u> . . . . .	2-60
2.13.3 <u>Informational/Error Messages</u> . . . . .	2-60
2.14 ARCHIVING OF MISSION DATA. . . . .	2-62

Section	Page
2.14.1 <u>Input</u> . . . . .	2-62
2.14.2 <u>Processing</u> . . . . .	2-64
2.14.3 <u>Output</u> . . . . .	2-65
2.14.4 <u>Informational/Error Messages</u> . . . . .	2-65
2.15 DUMPING OF TAPE OR DISK DATA . . . . .	2-67
2.15.1 <u>Input</u> . . . . .	2-67
2.15.2 <u>Output</u> . . . . .	2-68
2.15.3 <u>Informational/Error Messages</u> . . . . .	2-69
3.0 <u>INITIAL LOADING OF DATA BASES</u> . . . . .	3-1
4.0 <u>PROCEDURE FOR RELOADING AFTER SYSTEM FAILURE</u> . . . . .	4-1

## TABLES

Table		Page
1-I	TMS DATA BASES . . . . .	1-4
2-I	STDB DIRECTORY . . . . .	2-14
2-II	STDB MEASUREMENT DESCRIPTOR RECORD . . . . .	2-15
2-III	CDB CYBER 74 JOB SETUP . . . . .	2-23
2-IV	SELECT RUN 1 . . . . .	2-26
2-V	SELECT RUN 2 . . . . .	2-26
2-VI	SELECT RUN 3 . . . . .	2-27
2-VII	SELECT RUN 4 . . . . .	2-27
2-VIII	BLDCDB TYPE 2 LEAD CARD. . . . .	2-29
2-IX	BLDCDB TYPE 3 LEAD CARD. . . . .	2-29

## FIGURES

Figure		Page
1-1	TMS data flow. . . . .	1-8
2-1	CDB functional flow chart. . . . .	2-24
2-2	Calibration data base descriptor . . . . .	2-32
2-3	NIP/STCS tape summary. . . . .	2-44



## ACRONYMS

CCT	Computer Compatible Tape
CDB	Calibration Data Base
CDS	Continuous Data Segment
DDC	Data Distribution Center
DFI	Development Flight Instrumentation
GPC	General Purpose Computer
IDSD	Institutional Data Systems Division
IES	Information Extraction System
MMDB	Master Measurement Data Base
MSID	Measurement/Stimulus Identification
NIP	Network Interface Processor
ODRC	Orbiter Data Reduction Complex
OFT	Orbital Flight Test
OI	Operational Instrumentation
SMD	Structures and Mechanics Division
STCS	Special Telemetry Conversion System
STDB	Support Tables Data Base
TMS	Trend Monitoring System

## 1.0 INTRODUCTION

The Trend Monitoring System (TMS) is designed and developed to fulfill a requirement by the Structures and Mechanics Division (SMD) to display, on graphic terminals, thermal data from the Shuttle Orbiter. The system is required to maintain and display data collected during an entire mission. The system is also required to display data from a predicted or past mission along with the current mission data.

### 1.1 PURPOSE

This document provides information for the TMS Data Manager and serves as a guide to building and maintaining the data bases necessary in performing system functions. As different conditions present themselves during a mission, the data manager must analyze the situation and make decisions to keep the system going. This guide will assist the data manager in analyzing problems so he can make the correct decisions so the system can fulfill its requirements.

### 1.2 SYSTEM OVERVIEW

The TMS consists of a large minicomputer with a card reader, printer, three tape drives, two large data disks, one small system disk, an alpha/numeric terminal (available for data manager), up to eight graphic terminals and three printer/plotters for use by terminal operators. Currently seven graphic terminals are with the system and one will remain with the development team.

The system maintains on-line (large data disk) all data necessary for quick access. This data consists of all required data from a predicted mission and a past mission. On-line current mission data consists of parameter names, support tables, calibration data, all low- and medium-rate data, and limited high-rate data for each terminal. For display purposes, it also contains display information for up to 999 display formats.

All data except current mission data must be loaded into data bases before a mission begins. These data bases are updated or changed during a mission if necessary. As current mission data is received via the Network Interface Processor (NIP) computer compatible tapes (CCT's) during the mission, the desired parameters are extracted, calibrated, and added to the current mission data bases based on time. A data directory is also maintained of all data received and extracted by the system.

The user retrieves data from any of the mission data bases as defined in the display format and displays that data on an interactive basis on the graphic terminal. The user also displays data availability information from the data directory

and makes hard copies of data from his terminal. Current mission high-rate data is only extracted from the working file upon user request. The working file maintains on-line as much data as possible at one sample/sec. As the file is filled, the oldest data received is overlaid. If destroyed data is necessary for extracting high-rate data, the data must be restored to the working file. The data can be restored from an intermediate tape that was cut when the NIP CCT was processed.

### 1.3 DATA MANAGER'S FUNCTION

The TMS Data Manager is the central point of contact between the user (the SMD Data Analysis Coordinator) and the Institutional Data Systems Division (IDSD). The data manager must coordinate the initial loading and updating of data bases. The user must coordinate all data base change requests through the data manager. Within IDSD the data manager is responsible for distribution of all data and coordinates data problems.

The TMS Data Manager is also responsible for maintaining, near the TMS computer during a mission, a tape library that contains data necessary to rebuild any of the data bases that might be lost due to system failure or system limitations.

The TMS Data Manager must coordinate with the Orbiter Data Reduction Complex (ODRC) Data Manager such things as calibration tape, support tapes, and priorities of NIP tapes if necessary.

### 1.4 DATA MANAGER'S INTERFACES

Since the data manager is the central point of contact in IDSD for the TMS, he must interface with all system users, operators, and maintenance personnel. Most data requests are handled automatically by the system but requests to change data bases must be coordinated between the user and the TMS Data Manager. The data manager must then relay this request to the computer operator along with all pertinent information about where the data is located and what TMS program must be executed to fulfill the request.

Within IDSD the TMS Data Manager must interface with the ODRC Data Manager to ensure current information for extraction and calibration of data from NIP CCT's.

## 1.5 SYSTEM DATA BASES

### 1.5.1 Measurement/Stimulus Identification Data Base

The Measurement/Stimulus Identification (MSID) Data Base contains names of all parameters to be processed by the system. Each name is eight characters long. The data base contains low- and high-limit line values for each parameter. A table of pointers for the predicted and past mission high-rate parameters is also contained in the data base. All other data bases in the system are based and ordered dependent on the parameter names contained in this data base. Table 1-I contains information about the assigned files on the TMS. Some data bases consist of more than one file.

### 1.5.2 Support Tables Data Base

The Support Tables Data Base (STDB) contains information necessary to extract all parameters defined in the MSID data base for all downlink and downlist formats contained on the support tape supplied by the Ground Data Systems Division (GDSD). Extraction information for each downlink format is ordered dependent on parameter position in the MSID data base. For parameters contained in the downlist formats, additional pointers are required due to the number of downlist formats expected and the limited number of parameters in the formats. Extraction and storage information for downlist formats is compressed to contain information for only the parameters contained in the downlist format.

### 1.5.3 Calibration Data Base

The Calibration Data Base (CDB) contains the offset and coefficients necessary to convert from counts to engineering units. The data base also contains a table of pointers ordered according to the parameters in the MSID data base. All calibration information is assumed to be in the order of a polynomial. Only unique sets of coefficients are saved in the data base and the pointers point to the coefficients to use for each parameter. The calibration data is extracted from a calibration tape that is written from information contained in the Master Measurement Data Base (MNDB).

ORIGINAL PAGE IS  
OF POOR QUALITY

TABLE 1-I.- TMS DATA BASES

<u>File description</u>	<u>Disk file no.</u>	<u>Size (no. tracks)</u>	<u>Max. parm. entries</u>	<u>Initialized (Sec. No.)</u>	<u>Updated (Sec. No.)</u>
Current Mission High Rate - Terminal 1	1	20	20	2.10	2.10
Current Mission High Rate - Terminal 2	2	20	20	2.10	2.10
Current Mission High Rate - Terminal 3	3	20	20	2.10	2.10
Current Mission High Rate - Terminal 4	4	20	20	2.10	2.10
Current Mission High Rate - Terminal 5	5	20	20	2.10	2.10
Current Mission High Rate - Terminal 6	6	20	20	2.10	2.10
Current Mission High Rate - Terminal 7	7	20	20	2.10	2.10
Current Mission High Rate - Terminal 8	8	20	20	2.10	2.10
MSID	21	2	800	2.1	2.1
High-Rate Load Groups	22	1	99	2.2	2.2
Calibration	23	1	<sup>a</sup> 200	2.5	2.5
Support Tables	24	15	<sup>b</sup> 35	2.4	2.4
Display Formats	25	6	999	2.3	2.3
Data Directory	30	15	1343	2.7	2.9
Predicted Mission Medium Rate	31	120	60		2.6
Past Mission Medium Rate	32	120	60		2.6
Current Mission Medium Rate	33	120	60	2.7	2.9
Predicted Mission Low Rate	34	370	740		2.6
Past Mission Low Rate	35	370	740		2.6
Current Mission Low Rate	36	370	740	2.7	2.9
Predicted Mission High Rate	37	450	150		2.6
Past Mission High Rate	38	450	150		2.6
Working File (1 Large Disk)	63	4000	6 2/3 Hrs.		2.8
Working File (2 Large Disks)	64	7300	12 Hrs		2.8

<sup>a</sup>Maximum of 200 curves and each can be the 5th order

<sup>b</sup>Maximum of 35 formats (downlink and downlist)

#### 1.5.4 High-Rate Load Groups Data Base

The High-Rate Load Groups Data Base contains pointers to which of the 800 parameters are contained in that load group. A load group may contain up to 20 parameters and there may be up to 99 load groups. The same parameter may be in different groups and some parameters may not be in any group. The pointers are based on the order of parameters in the MSID data base.

#### 1.5.5 Display Formats Data Base

The Display Formats Data Base contains information necessary to retrieve and display the parameters specified for each format. There is a limit of 6 parameters per display format and a maximum of 999 display formats. Some or all of these formats may be built pre-mission. Formats that are not built and locked pre-mission may be built or changed during the mission from the users' terminals.

#### 1.5.6 Predicted Mission Data Base

The Predicted Mission Data Base consists of three separate files for low-, medium-, and high-rate parameters. As the low- and medium-rate files are loaded, the parameters are ordered according to the parameter names in the MSID data base. As the high-rate file is loaded, a table of pointers is built specifying which parameters are loaded as high-rate. This set of high-rate data pointers is added to the MSID data base. All parameter values are in floating-point engineering units.

#### 1.5.7 Past Mission Data Base

The Past Mission Data Base consists of three separate files for low-, medium-, and high-rate parameters. As the low- and medium-rate files are loaded, the parameters are ordered according to the parameter names in the MSID data base. As the high-rate file is loaded, a table of pointers is built specifying which are loaded in the high-rate file and where they are located within the file. This table of high-rate data pointers is added to the MSID data base. All parameter values are in floating-point engineering units.

#### 1.5.8 Current Mission Data Directory

The Current Mission Data Directory data base consists of two files and contains information about each Continuous Data Segment (CDS) (defined in sec. 2.8.1) received from the NIP CCT's. One file is the expanded CDS file and the other is the sorted times file. Each entry in the expanded CDS file contains the number of logical records in the CDS, the disk address if in the working file, the data format ID, the NIP-tape accession number, the TMS-intermediate tape number, the start time, the time interval, etc.

ORIGINAL PAGE IS  
OF POOR QUALITY

These entries are in the order received by the TMS. Each entry in the sorted times file contains start time, entry number, and time interval extracted from the expanded CDS file and sorted by start time. This file is updated and resorted after each NIP CCT is processed.

#### 1.5.9 Current Mission Low/Medium Rate Data Base

The Current Mission Low/Medium Rate Data Base consists of two files. One file contains the medium-rate data sorted by parameter and ordered according to the parameters in the MSID data base. The other file contains the low-rate data sorted by parameter and ordered according to the parameters in the MSID data base. This data base must be initialized before the start of a mission. Initialization consists of storing a fill pattern for every parameter and time slot in the data base. Data is added as NIP tapes are received and processed. The data is stored in the data base based on time to start accepting data and the time tag from the NIP CCT. All the parameter values are in floating-point engineering units.

#### 1.5.10 Current Mission High-Rate Data Base

The Current Mission High-Rate Data Base consists of eight files. A file is assigned to each terminal for that terminal's exclusive use. The data in each file is sorted by parameter and ordered according to the order in the high-rate load group. All parameter values are in floating-point engineering units. Data is loaded in these files upon request by the terminal operator and all previous data in the file is destroyed. Data in each file is at one sample/sec starting at the requested start time. Data values are set to a fill pattern when not found for a time.

#### 1.5.11 Working File Data Base

The Working File Data Base consists of a file of data in the order received by TMS. It is a rotating-type data base that will hold approximately 12 hours of data as extracted from the NIP CCT's. When the file is filled and additional data is received, the data written to the file first is overlaid. The data in the file is in counts at one sample/sec as extracted from the NIP CCT and in the order of the parameters in the MSID data base. A copy of the data extracted from each NIP CCT is also maintained on the TMS-intermediate tape so that data in the working file can be reloaded in case of a system crash or data is needed for a high-rate load group that has been overlaid.

### 1.6 SYSTEM DATA FLOW

This section addresses current mission data (NIP CCT) flow through TMS. Figure 1-1 shows TMS data flow. All predefined data bases are assumed loaded before the first NIP CCT is

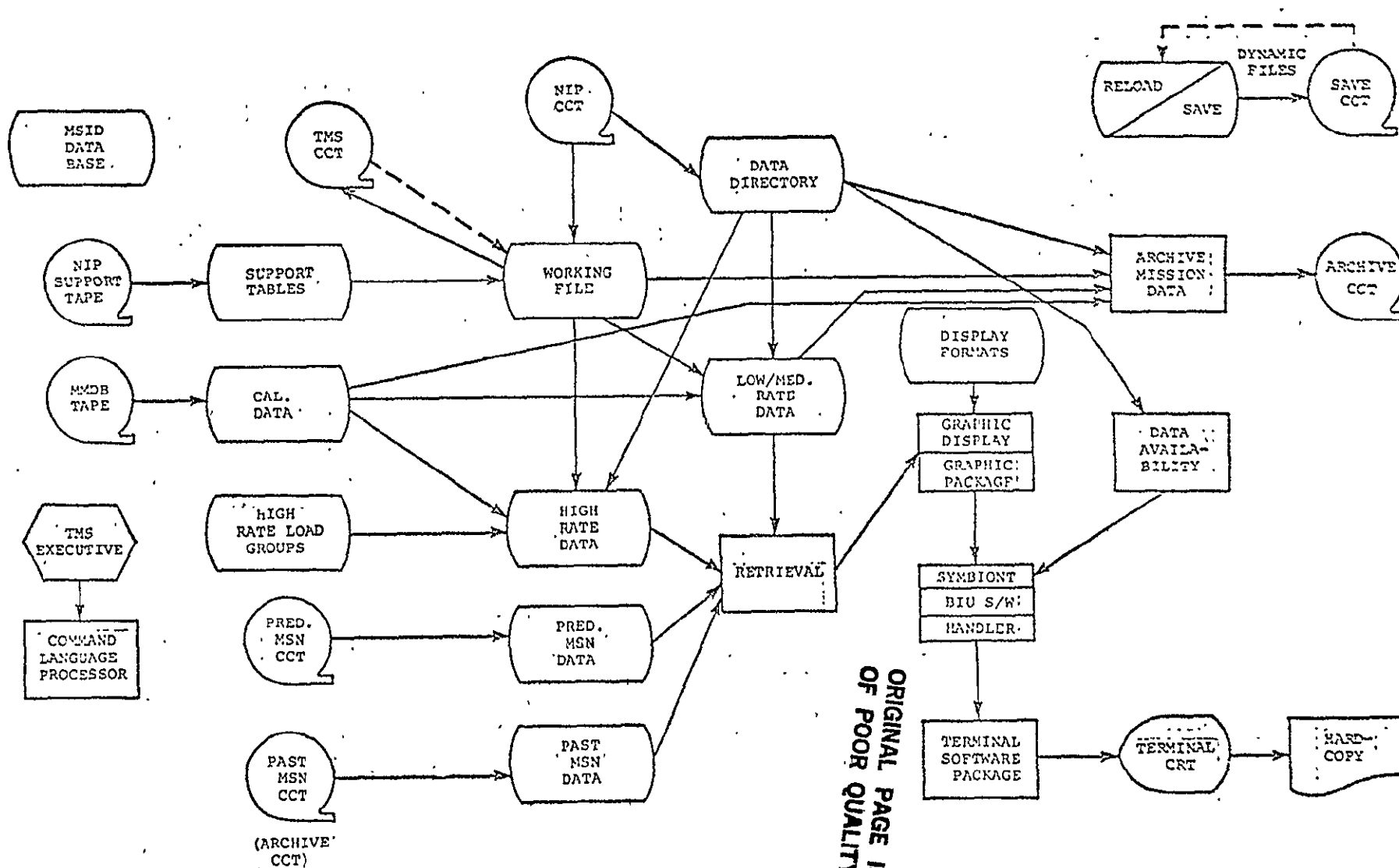
received. The NIP CCT received from GDSD should be logged in by the Data Distribution Center (DDC) with an accession number. The NIP CCT should then be input to TMS along with a TMS-intermediate tape for output of extracted data. The NIP CCT is no longer needed at the TMS. If a NIP CCT cannot be processed by TMS, a tape analysis will have to be done on the CYBER and corrective action taken.

The data extracted from the NIP CCT consists of entries for the data directory plus the desired parameters at the rate of one sample/sec. This data is output to a disk working file from which the low- and medium-rate data are extracted, calibrated, and added to those data bases. The data directory entries are added to the data directory after the low/medium rate data base is updated. The data contained in these data bases may be displayed at any time on command from the user.

For high-rate data the user must request a high-rate load group for a time interval to be loaded to his terminal's private file. Records are kept in the data directory whether data for the entries are currently in the working file or not. If all data requested is in the working file, it is extracted, calibrated, and stored into the terminal's private high-rate file. If some of the data is not currently in the working file, the data there will be extracted and saved. The computer operator will be requested to load the tape(s) containing the desired data to the working file. After this is done the remaining data will be added to that already saved, calibrated, and stored in the terminal's private file. The user will then be notified that the requested data is ready for display.

The intermediate tape must be maintained in a library near the TMS computer due to response required in restoring data for high-rate load groups.





ORIGINAL PAGE IS  
OF POOR QUALITY

Figure 1-1.- TMS data flow.

## 2.0 TMS DATA BASE MANAGEMENT FUNCTIONS

### 2.1 LOADING MSID DATA BASE

The MSID data base is the key to building all other supporting data bases for processing data on TMS. This data base is built from a card deck furnished to IDSD by SMD. This card deck contains the parameter names, sample rate, and limit line values for all measurements to be processed by the TMS. There is a limit of 800 parameter names. Not more than 60 may be specified as medium-rate parameters and the remainder are low-rate parameters. This data base must be on disk before the other supporting data bases can be built since data from other sources are extracted only for these parameters. If this data base is changed, all other data bases must be updated also.

#### 2.1.1 Input

The input to this data base is a card deck furnished to IDSD by SMD. Each card has up to three parameter names, sample rate, and the low- and high-limit line values for each parameter. One card is added to the deck as an ID card. The format of the cards follows:

<u>Card</u>	<u>Column</u>	<u>Description</u>
1	1-8	8-character deck ID
	13-15	Initial loading of the specific data base disk for a specific TMS mission. = YES - Initial load ≠ YES - Not initial load
	17-20	Type of parameters - left justified = DFI - Assumed to be DFI parameters ≠ DFI - Assumed to be OI parameters
	76-80	Sequence Number Must be blank or zero

If card 1 is an EOF card, the MSID data base on disk is printed. An EOF card has the special character '\$' punched in columns 1 and 2. An EOF terminates the deck.

<u>Card</u>	<u>Column</u>	<u>Description</u>
2-N	1-10	MSID number (parameter name) <sup>1</sup>
	12	Sample rate 'L' = Low only <sup>2</sup> 'M' = Medium only <sup>2</sup> 'H' = High and low <sup>2</sup>
	13-16	Low-limit line value <sup>3</sup> (engineering units)
	17-20	High-limit line value <sup>3</sup> (engineering units)
	26-35	MSID number <sup>1</sup>
	37	Sample rate (Same as column 12) <sup>2</sup>
	38-41	Low-limit line value <sup>3</sup>
	42-45	High-limit line value <sup>3</sup>
	51-60	MSID number <sup>1</sup>
	62	Sample rate (Same as column 12) <sup>2</sup>
	63-66	Low-limit line value <sup>3</sup>
	67-70	High-limit line value <sup>3</sup>
	76-80	Card Sequence Number <sup>4</sup>

<sup>1</sup>Up to 800 parameters may be input, with a maximum of 60 medium-rate and 740 low only or low- and high-rates. Any of the three MSID's in a card may be left blank and these positions are not counted in the total. Only the first eight characters of the parameter names are used and stored in the MSID data base.

<sup>2</sup>Sample rate must be one of the valid rates ('L', 'M' or 'H').

<sup>3</sup>Limit line values may be blank. If they are blank, a value of 9999.0 is stored in the data base.

<sup>4</sup>Sequence numbers should increment but not more than 10.

## 2.1.2 Output

The output of this task is the MSID data base including the limit line values for each parameter written to disk. The first 60 parameter slots are reserved for the medium-rate parameters. If there are less than 60 medium-rate parameters input, 60 parameters are output with blank fill up to 60. The low-rate parameters start at the 61st parameter in the MSID data base. If there are less than 740 low-rate parameters, blank fill is output to make up 740 low-rate parameters. The task also prints the MSID data base including limit lines and the order the parameters are in the data base. No data base is output to the disk under certain error conditions (sec. 2.1.3).

ORIGINAL PAGE IS  
OF POOR QUALITY

### 2.1.3 Informational/Error Messages

The following informational or error messages are output by the task to the printer:

a. 'ERROR MESSAGES'

A header message and the actual error messages will follow.

b. 'FIRST CARD MUST BE MSN ID AND NO SEQUENCE NO.'

The first card of the deck contained something in columns 76 through 80. Job terminated, old data base remains.

c. 'ERROR SEQUENCE X PREVIOUS NO. Y'

Where X and Y are card sequence numbers. The sequence number in two consecutive cards did not increment properly. Parameters in card processed but data base will not be output.

d. 'INVALID SAMPLE RATE - SEQ. X'

Where X is card sequence number. The sample rate for one of the parameters in the card was not an 'L', 'M', or 'H'. The parameter is deleted from output.

e. 'TOO MANY A RATE PARAMETERS B X'

Where A = 'HIGH', 'MED', or 'LOW', B = parameter name, and X = card sequence number. The parameter is deleted from the specified data base. The data base is output with this error but all parameters over the acceptable number for each rate are deleted.

f. 'SEQUENCE ERROR - NO DATA BASE OUTPUT'

There was a card sequence number error in the deck, therefore no MSID data base output to disk. The card sequence number with the error appeared in a previous message. The old data base remains intact.

## 2.2 LOADING HIGH-RATE LOAD GROUPS

The high-rate load group is defined as a group of parameters to be extracted from the total set of 800 parameters and stored in a terminal's private, current mission high-rate data file. The maximum number of parameters per group is 20. The maximum number of groups is 99. The group number and the parameter names to be associated with that group must be supplied to IDSD by SMD before a mission. The MSID data base must be on disk before this task can be executed. The task may be run at any time after the MSID data base task and must be rerun if the MSID data base is changed.

### 2.2.1 Input

The input to the High-Rate Load Groups data base is a card deck. The information for the card deck is supplied to IDSD by SMD on preprinted forms. The information on the forms must be punched before the data base can be built. The card format is as follows:

<u>Column</u>	<u>Description</u>
1-2	Load group number <sup>1</sup>
5-12	MSID <sup>2</sup> of 1st parameter on card
15-22	MSID <sup>2</sup> of 2nd parameter on card
25-32	MSID <sup>2</sup> of 3rd parameter on card
35-42	MSID <sup>2</sup> of 4th parameter on card
45-52	MSID <sup>2</sup> of 5th parameter on card
55-62	MSID <sup>2</sup> of 6th parameter on card
65-72	MSID <sup>2</sup> of 7th parameter on card
75-80	Card sequence number <sup>3</sup>

<sup>1</sup>Load group number is necessary in first card of a load group only. A load group is terminated by 20 parameter names or a new load group number in columns 1 and 2 of the card. Duplicate load group numbers are not allowed. A maximum of 20 parameter names per load group is allowed.

<sup>2</sup>If an MSID is left blank, that position is not counted as 1 of the 20 parameters per group.

<sup>3</sup>Card sequence numbers must increment but not more than a value of 10.

If only a listing of load group data base already on disk is desired, an EOF card is the only input card. An EOF card terminates the last load group.

### 2.2.2 Output

The output of this task is the High-Rate Load Group data base to disk. The load groups are stored in numerical order. Pointers to which of the 800 parameters are stored in the load group instead of the parameter names. A listing of all load groups in numerical order is also made. The listing contains the load group number and the parameter names and pointers. No data base is output to disk under certain conditions (sec. 2.2.3).

### 2.2.3 Informational/Error Messages

The following informational or error messages are output by the task to the printer:

a. 'ERROR MESSAGES'

A header message and the actual error messages follow.

b. 'ERROR SEQUENCE X PREVIOUS NO. Y'

Where X and Y are card sequence numbers. The sequence number in two consecutive cards did not increment properly. Parameters on card are processed but data base is not output.

c. 'INVALID LOAD GROUP X SEQUENCE Y'

Where X is load group number and Y is card sequence number. Load group number is less than 1 or greater than 99 in card with sequence number Y. Card is ignored and processing continues.

d. 'DUPLICATE LOAD GROUP X SEQUENCE Y'

Where X is load group number and Y is card sequence number. Load group number X is a duplicate of a previous load group number. Card is ignored and processing continues.

e. 'TOO MANY PARAMETERS LOAD GROUP XX'

More than 20 parameters found in load group XX. The first 20 are accepted.

f. 'M NOT FOUND - SEQUENCE X'

Where M is the eight-character parameter name and X is the card sequence number. The parameter name was not found in the MSID data base. The parameter is deleted from load group.

g. 'SEQUENCE ERROR - NO DATA BASE OUTPUT'

At least one card sequence error was detected in the deck and no data base was output to disk.

## 2.3 LOADING PREDEFINED DISPLAY FORMATS

Before data can be displayed on a terminal, a description of the parameters and display information must be defined in the Display Formats data base. Display formats may be built from a terminal but normally the information should be punched onto cards so the data base may be loaded before a mission. The maximum number of display formats is 999. There may be up to six parameters per format if only current mission data is to be displayed. The maximum is three parameters per format if current mission plus either predicted or past mission data is to be displayed. This data base must be rebuilt if the MSID data base is updated. It is recommended that all display formats be kept in the card deck just in case the MSID data base has to be updated. Reference 1 contains information on building display formats from a terminal.

### 2.3.1 Input

The input to this task that builds the predefined formats data base is a card deck. The card deck information is furnished to IDSD by SMD on preprinted forms. The information on the forms must be punched by IDSD before the data base can be built. Two additional cards must be added at the front of the deck before the task is executed. The card formats follow:

<u>Card number</u>	<u>Card column</u>	<u>Description</u>
1	4	Initial or update flag = 1 - Initialize entire data base before loading following formats. ≠ 1 - Update (replace) display formats specified in following deck.
	5-8	Number of copies of tabular report to generate. Defaults to two copies if no value input. NOTE: If card 1 is EOF card, the program outputs two copies of Display Formats data base.
2	1-80	Card deck identification NOTE: If card 2 is EOF card, program outputs the number of copies of Display Formats data base specified in card 1, but if column 4 of card 1 = 1, the data base will be destroyed.
3-N	1-3 4-7	Display format number Minimum Y value (vertical) (engineering units)



<u>Card number</u>	<u>Card column</u>	<u>Description</u>
	8	Number of Y divisions Should be 4, 5, or 6 (Default = 6)
	9-12	Y increment value (engineering units)
	13-16	Lower-limit line value if not declared in column 21 to be extracted from MSID data base (engineering units)
	17-20	Upper-limit line value if not declared in column 21 to be extracted from MSID data base (engineering units)
	21	Lower/Upper limit line measurement number flag, 1 through 6 are acceptable measure- ment numbers, 9 means to suppress limit lines, blank or zero defaults to 1. Measurement position in the card from which to extract the limit line values from the MSID data base. This column is ignored if values are detected in columns 13 through 20.
	22-25	Plot Type - 'CURR' = Current mission data only; 'PRED' = Predicted and current mission data; 'PREV' = Past and current mission data.
	26	Sample Rate Flag 'L' = Low- and/or medium-rate data 'H' = High-rate data only Default = 'L'
	27	Format Status Flag = * - Lock format in data base ≠ * - Do not lock format in data base
	28-35	Parameter name for measurement no. 1
	37-44	Parameter name for measurement no. 2
	46-53	Parameter name for measurement no. 3
	55-62	Parameter name for measurement no. 4
	64-71	Parameter name for measurement no. 5
	73-80	Parameter name for measurement no. 6 NOTE: If card 3 is an EOF card, program outputs specified number of copies and no updates, but if column 4 of card 1 = 1 data base has been destroyed.

If the plot type = 'CURR' then there may be up to six parameter names. If the plot type = 'PRED' or 'PREV' then there may be only three parameter names as the other three are assumed to be the same parameters except the data is to be extracted from the predicted or past mission data base.

### 2.3.2 Output

The output of this task is the Display Formats data base. The display formats are stored in numerical order. Pointers to the parameters are stored in the data base instead of the parameter names. A listing of all display formats in numerical order is also output. Multiple listings may be obtained by specifying number of copies on card 1.

### 2.3.3 Informational/Error Messages

The following informational or error messages may be output to the printer:

- a. '\*\*\*INPUT ERROR ON CARD BELOW AND WILL NOT BE STORED ON DATA BASE\*\*\*'

Alphabetical information was detected in one of the numerical fields in the card listed following the comment.

- b. '\*\*\*THE MAXIMUM 50 ERRORS ENCOUNTERED ON INPUT. JOB ABORTED\*\*\*'

Fifty errors explained above have been encountered. The task is terminated. It must be assumed the old data base is destroyed since part of it could have been updated before 50 errors were encountered.

- c. '\*\*\*WARNING\*\*\* FORMAT K HAS AN UNDEFINED MEASUREMENT NAME A THIS FORMAT CANNOT BE DEFINED ON THE DATA BASE'

Where K is the display format number and A is the parameter name. Parameter A could not be found in the MSID data base, therefore display format K is deleted.

- d. '\*\*\*WARNING\*\*\* ILLEGAL LINE VALUES DEFINITION. FORMAT K WILL HAVE LIMIT LINES SUPPRESSED'

Where K is the display format number. The limit line flag (card column 21) was set to 7, 8, or any number (except 9) larger than the number of measurements defined.

- e. '\*\*\*WARNING\*\*\* LIMIT VALUES WERE REVERSED IN FORMAT K'

Where K is the display format number. The upper-limit line value specified was less than the lower-limit line value. The program reverses the input values and continues.

- f. '\*\*\*WARNING\*\*\* FORMAT K WAS NOT STORED ON DATA BASE'

Where K is the display format number. A negative format number (K) was detected in the format number field of the card. Must search the input deck for this format number.

- g. 'INPUT ERROR ON FIRST CARD'

Alphabetical character was detected on the first input card (card 1).

- h. 'K TOTAL FORMATS WERE INPUT BY CARDS, N OF THESE WERE NOT STORED TO DATA BASE BECAUSE OF ERRORS'

Where K is the total number display format cards and N is the number of display formats that were not stored on the data base. Normal termination message.

- i. 'NOTE--THE FORMATS BELOW WERE PREVIOUSLY DEFINED BUT WERE UPDATED K, L, M...'

Where K, L, M... are the display formats that were updated. This message is written if it was not an initial execution for the data base but an update run and the specified formats were already in the data base. Information only.

## 2.4 BUILDING SUPPORT TABLES

This function builds the STDB that provides the necessary information to decommutate and process the input data recorded on NIP or Special Telemetry Conversion System (STCS) CCT's. The STDB contains the byte location, processing, and data validity information required to describe and retrieve data from a complete data cycle on the input NIP or STCS CCT.

The task that accomplishes this function is a batch-initiated program called STDBMP on the TMS MODCOMP 4 computer. Normally this task is a pre-mission function; however, this program can be executed as a batch initiated run during mission processing. The only restriction is the NIP tape processing program NIPP cannot be executing at the same time and the STDB for all subsequent runs will be changed to reflect the new support tables. Changing the STDB during the mission should only be done in case of an anomaly of major magnitude.

Program STDBMP inputs a NIP or STCS Support Table Tape and by using the MSID data base to identify measurements, serially constructs a support table for each format that contains TMS measurements on the input tape. The STDB contains retrieval information for both operational instrumentation (OI) and GPC formats.

Only support tables from one Flight ID per mission can be contained in the STDB, thus only one Support Table Tape is input to this program. Also only one STDB is stored on the TMS mass storage data base at any one time. After program STDBMP has been loaded and execution initiated, the existing STDB on disk is written over or destroyed. If an error occurs during execution that aborts this run, the STDB on disk should be considered invalid and will have to be reconstructed before any further NIP or STCS CCT's can be processed. The Flight ID in the STDB must correlate to the NIP or STCS data tapes to be processed later during mission processing.

The STDB contains a directory to provide visibility back to the support table tape, physical tape number, date tape made, etc. The directory also describes information required to locate the support table blocks for each format in the STDB.

The STDB is built assuming that all measurements are one sample/sec measurements. All OI and GPC measurements are 8-bit and 10-bit AMU measurements, respectively.

### 2.4.1 Input

Input to this function is either the NIP or the STCS Support Table Tape. The format of these tapes is the same as the support tapes used by the Information Extraction System (IES) on the

CYBER-74 computer for Shuttle Data Processing. The NIP Support Table Tape is supplied to IDSD from the GDSD. The format of the NIP Support Table Tape is described in reference 2. The STCS Support Table Tape format is described in reference 3. The STCS Support Table Tape is created on the CYBER 74 by a LES stand-alone program (BLDSTT) using the telemetry loading tapes from the MMDB as input.

Also the MSID data base described in section 2.1 is input from disk storage (logical file 21) by this program. This data base defines the data base type (either OI or Development Flight Instrumentation (DFI)) and the list of measurements that must be retrieved from the CCT's for the TMS.

Support tables will be built in the STDB for formats encountered on the Support Table Tape containing MSID's found in the MSID data base.

#### 2.4.2 Output

The output from this task is the STDB on disk storage and magnetic tape and a formatted listing on the standard output device.

The STDB is stored on disk storage, logical file 24. It contains the information required by the data processing program NIPP to locate, validate, and retrieve data from the NIP or STCS data tapes. The STDB is partitioned into blocks of information by format number. Each block contains the retrieval information for all TMS measurements contained in that particular format. For OI formats the block of retrieval information is sized for all 800 TMS measurements with the first byte locator set equal to -1 for MSID's not assigned to this format. For GPC formats the STDB block size is variable depending on the number of MSID's contained in each format. Each OI format requires 25 sectors of disk storage, while each GPC format requires from 1 to 25 sectors. The data base was sized to accept 35 formats, 10 OI and 25 GPC, each averaging 50 measurements per format.

Track 0, sectors 0 and 1, contains the STDB directory which contains the standard overhead information plus a description of how the data base is stored on the disk file. The directory overhead data includes Flight ID, date, tape number, data base type, etc., to differentiate this STDB from others. A description of the STDB Directory is contained in table 2-I.

The measurement descriptor record of the STDB is described in table 2-II. This part of data base is blocked on sector boundaries, one block per format. For each measurement in a format the following information is included:

- a. First byte locator
- b. Index to where this measurement is stored in output
- c. Validity flag word
- d. Validity flag mask

TABLE 2-I.- STDB DIRECTORY

Bytes (8-Bit)	Format type <sup>1</sup>	Description
1-2	I	Flight ID Number
3-10	A	Support Table Revision Date (MM/DD/YY)
11-16	A	Support Tape Physical Tape No. (6 chars.)
17-28	I	Date/Time STDB Created (6 integers) MM,DD,YY,HR,MN,SC
29-30	I	Update Counter (Zero for STDB build)
31-32	I	Number Formats in STDB (OI & GPC) (Max Allowed = 35)
33-44	I	Date/Time STDB Last Updated (6 integers)
45-46	I	Data Base Type (= 0 for OI, = 1 for DFI)
47-48	I	= 1 for NIP Tape, = 11 for STCS Tape
49-80		Spare
81-160	A	Support Table Tape Header ID Information (40 16-bit words)
161	I	Data Set ID 1st Format Number
162	I	First Format Number
163-164	I	Disk Address Where Support Table Infor- mation Stored 1st Format
165-166	I	Number Sectors Required First Format
167-168	I	Number TMS Measurement In First Format (Set = 800 for OI)
•	•	•
•	•	•
•	•	•
433	I	Data Set ID 35th Format Number
434	I	35th Format Number
435-436	I	Disk Address Where Support Table Information Stored 35th Format
437-438	I	Number Sectors Required 35th Format
439-440	I	Number TMS Measurement in 35th Format (Set = 800 for OI)
441-442	I	Data Set Length 1st Format
•	•	•
•	•	•
•	•	•
509-510	I	Data Set Length 35th Format
511-512		Spare

<sup>1</sup>I = Integer, A = ASCII

ORIGINAL PAGE IS  
OF POOR QUALITY

TABLE 2-11. - STDB MEASUREMENT DESCRIPTOR RECORD

Bytes (8-Bit)	Format type <sup>1</sup>	Description
1-2	I	1st Byte Locator for 1st parameter <sup>2</sup>
3-4	I	Index to location where data stored in output buffer this measurement
5-6	I	Validity flag word for 1st parameter
7-8	I	Validity flag mask for 1st parameter
9-10	I	1st byte locator for 2nd parameter
•		
•		
•		
•		
•		
6393-6394	I	1st byte locator for 800th parameter
6395-6396	I	Index to location where data stored in output buiffer this measurement
6397-6398	I	Validity flag word for 800th parameter
6399-6400	I	Validity flag mask for 800th parameter

<sup>1</sup>I = Integer

<sup>2</sup>For OI formats the descriptor defines the retrieval for all 800 measurements. For measurements not found on support tape for this format or blank in MSID, the 1st byte locator for this parameter is set to -1. For GPC formats retrieval information is stored in the STDB only for TMS measurements found in each format. A separate block of information or logical record is stored on sector boundaries in the STDB for each OI or GPC format on the Support Table Tape.



A 1600-bpi, 9-track magnetic tape is also written containing the STDB. Record 1 is the 256 word (16-bit) directory identical to sectors 1 and 2 of the STDB. Records 2 through N are the measurement descriptor records, one for each format. The record lengths are variable depending on the sector lengths of each format on the STDB. This tape can be used to reload the STDB without having to reload the NIP or STCS Support Table Tapes.

This task outputs on the standard output device a report describing the processing performed to construct the STDB and the STDB itself. This report should be used to check the STDB for completeness and accuracy, as well as a record for future reference.

The output report on the printer produces the following types of output. Each format on the NIP or STCS Support Table Tape is listed by one of the following:

- a. Formats that contain no TMS measurements produce the following output:

```
SUPPORT TABLE DATA BASE FORMAT LISTING
FLIGHT IDENTIFICATION NUMBER - 15
DOWNLINK/DOWNLIST FORMAT NO. - 20
DATA SET IDENTIFICATION NO. - 20
NO TMS MEASUREMENTS IN THIS FORMAT--- FORMAT SKIPPED
```

- b. For OI formats the STDB describes the entire 800 measurements in the MSID data base. A listing of all measurements not encountered on the support tape is output.

Example:

MEASUREMENTS NOT LOCATED ON SUPPORT TABLE TAPE FOR  
DATA SET = 10 FMT NO = 129

ENTRY	MEASUREMENT ID
6	V58T0183
12	V58T0283
13	V58T0286
14	V58T0288
21	V58T0383
22	V58T0386
23	V58T0388
89	V09T9307
90	V09T9309
94	V09T9359
.	.
.	.
.	.
749	V92T3722
750	V92T3723
751	V92T3724

The listing of the missing measurements is followed by the listing of the OI format:

SUPPORT TABLE DATA BASE FORMAT LISTING

FLIGHT IDENTIFICATION NUMBER - 15

DOWNLINK/DOWNLIST FORMAT NO. - 129

DATA SET IDENTIFICATION NO. - 10

ENTRY NO.	MEASUREMENT NUMBER	FIRST BYTE LOCATOR	STORAGE PTR. (800 WD ARRAY)	VALIDITY FLAG WORD	VALIDITY FLAG MASK
1	V58T0119	6731	1	1	8000
2	V58T0120	5187	2	1	8000
3	V58T0122	7564	3	1	8000
4	V58T0157	0	4	1	8000
5	V58T0159	0	5	1	8000
6	V58T0183	-1	6	0	0
7	V58T0198	7015	7	1	8000
8	V58T0219	7446	8	1	8000
9	V58T0220	7422	9	1	8000
10	V58T0222	6955	10	1	8000
	*	*	*	*	*
	*	*	*	*	*
	*	*	*	*	*
795		-1	795	0	0
796		-1	796	0	0
797		-1	797	0	0
798		-1	798	0	0
799		-1	799	0	0
800		-1	800	0	0

- c. For GPC formats the listing of the support table for a format is the same as OI except a listing of missing TMS measurements is not output and after listing the MSID's found, the output terminates.

SUPPORT TABLE DATA BASE FORMAT LISTING

FLIGHT IDENTIFICATION NUMBER - 15

DOWNLINK/DOWNLIST FORMAT NO. - 42

DATA SET IDENTIFICATION NO. - 20

ORIGINAL PAGE IS  
OF POOR QUALITY

ENTRY NO.	MEASUREMENT NUMBER	FIRST BYTE LCCATOR	STORAGE PTR. (800 WD ARRAY)	VALIDITY FLAG WORD	VALIDITY FLAG MASK
1	V42T1100	5603	171	2	2000
2	V42T1104	5749	172	2	800
3	V42T1200	5753	173	2	800
4	V42T1300	5599	176	2	2000
5	V42T1501	6075	179	2	80
6	V42T1503	5989	180	2	100
7	V42T1505	4383	181	1	800
8	V42T1507	6077	182	2	80
9	V42T1509	5991	183	2	100
10	V42T1511	4385	184	1	800

50	V42T3515	5923	228	2	200
51	V42T3517	5837	229	2	400
52	V42T3519	5925	230	2	200
53	V42T3521	3675	231	1	2000

- d. After a listing of each format is output a summary of the directory is output. This describes content and disk location of the data base.

#### SUPPORT TABLE DATA BASE SUMMARY

FLIGHT IDENTIFICATION NUMBER - 15  
 SUPPORT TABLE TAPE NUMBER - T00696  
 SUPPORT TAPE REVISION DATE - 05 25 78  
 SUPPORT TABLE DB UPDATE CTR. - 0  
 NUMBER FORMATS IN DATA BASE - 3  
 SUPPORT TABLE DATA BASE CREATED - DATE: MO/DAY/YR 9/19/1978 TIME:  
 SUPPORT TABLE DATA BASE UPDATED - DATE: MO/DAY/YR 0/ 0/ 0 TIME:  
 STDB TAPE DEST. HEADER REC. (80 BYTES) -  
 TPC DECOM DATA FOR MISSION OPT VEH ID 102 FLIGHT 0001 LINK CD  
 STDB STORAGE DESCRIPTION: 05 25 78 REV A

ENTRY LOC.	DATA SET ID.	DLINK/LIST FORMAT ID.	DISC ADD. (SECTOR)	NUMBER SECTORS	NUMBER MEAS.	DATA SET LENGTH
81	20	42	1	2	58	6120
85	20	44	3	2	58	5880
89	10	129	5	25	800	7860

JOB COMPLETED

### 2.4.3 Diagnostic Error Messages

- a. 'JOB ABORTED - SUPPORT TABLE TAPE PARITY ERROR - ISTAT = XX'

A parity error has been encountered in record XX. Job aborts and a new support tape must be requested. The previous STDB has been destroyed.

- b. 'JOB ABORTED - SUPPORT TAELE TAPE END OF FILE--REC. 1'

An illegal condition has occurred on input tape, check input tape and request another if necessary before rerunning job. The previous STDB has been destroyed.

- c. 'JOB ABORTED - ERROR REC1 Byte 81-83 = AAA'

Bytes 81 through 83 must equal OFI, support tape error. The previous STDB is still intact on disk.

- d. 'JOB ABORTED - FATAL TAPE READ ERROR - RECORD NO. XXXX'

Tape driver returned illegal status, restart job. If the error persists change tape drives or request new Support Table Tape. The previous STDB has been destroyed.

- e. 'ERROR - MEAS IDDB ID. REC. BYTES (39-40) = XX'

MSID data base bytes 39-40  $\neq$  OI or DFI. This is fatal error because BLDCDB uses this field to determine if support table is OI or DFI. The previous STDB on disk is still intact.

- f. 'ERROR - RECORD CGUNTER ERROR ON SUPPORT TABLE - SEQ REC CTR = XXXX PREVIOUS REC CTR - XXXX NO. RECORDS THIS FORMAT = XXXX'

Error in record counter on input support tape. This is a diagnostic, run continues.

- g. 'NO OI/DFI FORMATS ENCOUNTERED ON SUPPORT TAPE BEFORE END OF FILE - NO. REC. READ = XXXX'

There were XXXX records read and no format encountered with TMS measurements. Probably wrong Support Table Tape was mounted. Check this and rerun job. The previous STDB on disk is still intact.

- h. 'ERROR WRITING OUTPUT TAPE REC XXX JOB ABORTED'

The tape driver encountered a fatal error while writing output tape. Mount new tape and rerun job. The previous STDB on disk has already been destroyed.

i. 'ERROR - DIRECTORY OVERFLOW, NO. FORMATS EXCEEDED 35'

The number of OI and GPC formats containing TMS measurements exceeded 35. This exceeds capability of directory, must get another support tape with some formats deleted and rerun. The previous STDB on disk has been destroyed.

ORIGINAL PAGE IS  
OF POOR QUALITY

## 2.5 BUILDING CALIBRATION DATA BASE

Calibration information required to calibrate all measurements in the TMS is contained in the CDB. The function of constructing and storing the CDB on MODCOMP mass storage is performed by a pre-mission batch task. The CDB utilizes 1 track of disk file and is defined as logical file 23 by the TMS.

The procedure used to construct the CDB incorporates the CYBER 74 and the MODCOMP 4 computers. The CYBER 74 inputs the MMDB calibration tapes (same calibration tapes as used by the IES), extracts the required calibration information for the TMS measurements, and punches a card deck for use later on the MODCOMP 4. The input MMDB calibration tapes can be either the Rockwell International (RI) downlist and downlink calibration tapes or the IDSD calibration tape. The format of the RI downlist and downlink calibration tapes is described in reference 4. The format of the IDSD calibration containing the downlink calibrations in File 2 and the downlist calibrations in File 4 is described in reference 5.

The card deck output by the CYBER 74 contains two type cards. The first type card contains the curve type and the coefficients for that standard calibration. The second type card contains the MSID and the particular curve type to be used to calibrate this measurement. This card deck is then input to the MODCOMP 4 program BLDCDB that constructs the CDB on disk storage.

Listings are produced on both the CYBER 74 and the MODCOMP 4 standard output devices to aid the data managers in assuring the users that the CDB is correct.

The CDB is a table of 800 pointers, one for each measurement in the MSID data base, and a table containing for each unique curve type the number of coefficients followed by the polynomial coefficients. The position in the pointer table parallels the MSID data base to correlate the CDB to the MSID's. The table of pointers indexes the programs using the CDB to the actual calibrations for each measurement (number of coefficients and coefficients).

The CDB for the TMS is constructed using the assumption that standard calibrations are incorporated; i.e., several measurements share the same calibration curves. The CDB is sized for a maximum of 200 unique curve types each fit to a polynomial of the 5th order or less. If this limit is exceeded, a diagnostic will be output on the standard output device, the CDB will not be output to disk, and the previous CDB on disk storage will still be intact.

Updates to the CDB are made by manually updating the card deck input by the MODCOMP program that constructs the CDB. All fields

on this card deck can be changed; however, care should be taken when changing this deck because several measurements can share the same calibration curve type. Also only one CDB can reside on the disk at any one time. When a new CDB is constructed, either to modify the existing CDB or create a new CDB from another MMDB calibration tape, it destroys the old or existing CDB on disk storage. Backup or previous CDB's should be kept in card deck form as this is only method of returning to a previous CDB. If because of disk failure or some type of hardware/software error the CDB must be reconstructed, it can be rebuilt in approximately 1 minute from this card deck.

The functional flow diagram in figure 2-1 shows the steps taken to construct the CDB. Section 2.5.1 describes the processing performed using the CYBER 74 computer and Section 2.5.2 describes the processing performed on the MODCOMP 4 computer.

#### 2.5.1 CDB CYBER 74 Processing

The CYBER 74 task inputs the MMDB calibration tapes, downlink and downlist, extracts the necessary parameters, and punches a card deck containing the calibrations for all TMS measurements. The deck setup to accomplish this task on the CYBER 74 is listed in table 2-III. This run sequence must be adhered to because the output files from the initial runs are input files for later executions.

The calibration effort on the CYBER 74 is essentially accomplished in six separate executions. This runstream incorporates an existing program SELECT developed on the CYBER for the IES. This program inputs character-oriented information (calibration tapes), selects specified pieces of information for output, rearranges these pieces according to lead card input, then outputs these data to a formatted file. A copy of the program document for SELECT is found in reference 6, section 4.4.3.

TABLE 2-III.- CDB CYBER 74 JOB SETUP

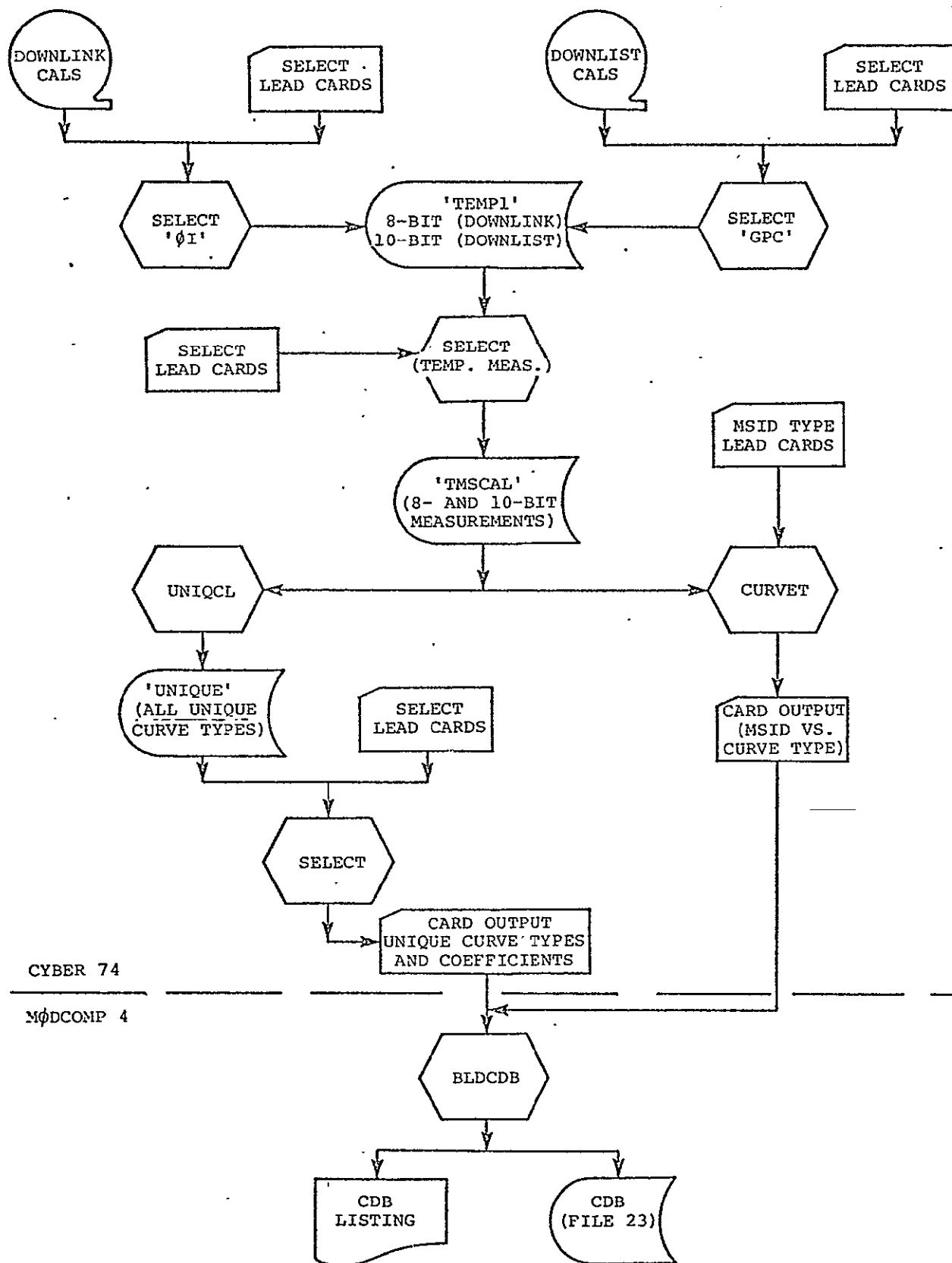
```

Job Card
User Card
Charge Card
ATTACH(SELECT/UN=DRC007,PH=TEAL,M=R)
ATTACH(UNIQCL/UN=DRC007,M=R)
ATTACH(CURVET/UN=DRC007,M=R)
RESOURC(NT=2)
REQUEST(TAPE1,D=800,NT,PO=NRP,F=L) **Reel No.**
REQUEST(TAPE2,D=800,NT,PO=NRP,F=L) **Reel No.**
SELECT(,,TEMP1)
SELECT(,,TEMP1)
REWIND(TEMP1)
COPY(TEMP1)
REWIND(TEMP1)
SELECT(,,TMSCAL,,,TEMP1)
REWIND(TMSCAL)
COPY(TMSCAL)
REWIND(TMSCAL)
MAP(PART)
UNIQCL(TMSCAL,UNIQUE)
REWIND(UNIQUE)
COPY(UNIQUE)
REWIND(UNIQUE)
SELECT(,,,,UNIQUE)
REWIND(TMSCAL)
MAP(PART)
CURVET(,,,TMSCAL)
7/8/9 (col.1)
...Lead Cards (1st SELECT Execution)
7/8/9 (col.1)
...Lead Cards (2nd SELECT Execution)
7/8/9 (col.1)
...Lead Cards (3rd SELECT Execution)
7/8/9 (col.1)
...Lead Cards (4th SELECT Execution)
7/8/9 (col.1)
    TYPE1 CURVET Lead Card
...TYPE2 CURVET Lead Cards
END CARD
6/7/8/9 (col.1)

```

ORIGINAL PAGE IS  
OF POOR QUALITY





CYBER 74

MØDCOMP 4

Figure 2-1.- CDB functional flow chart.

The first SELECT run reads the downlink calibration tape and extracts all 8-bit measurements and writes them to a temporary mass-storage file (TEMP1). Table 2-IV details the extracted parameters and their locations in the input and output records.

The second SELECT run performs the same function except it extracts all 10-bit measurements from the downlink calibration tape. Table 2-V details the parameters and their locations in the input and output record. At this point all 8-bit OI and 10-bit GPC measurements are stored in the temporary file TEMP1.

The third SELECT run uses the temporary disk file TEMP1 as the input data and extracts all measurements that are temperatures (col. 4 in measurement ID equals T). The measurements extracted by this run are output to a temporary mass-storage file (TMSCAL) in the same format as the input file TEMP1. The format is described in table 2-VI.

The next program to execute in the CYBER 74 run string is UNIQCL using temporary file TMSCAL as input. UNIQCL reads file TMSCAL and builds an output temporary file UNIQUE containing all entries in the input file that have a unique curve type. Several measurements will have the same curve type but only the measurement having the first occurrence of each non-blank unique curve type will be output to this file. The format of file UNIQUE is the same as the input file TMSCAL.

The execution of program UNIQCL is followed by another SELECT run to extract from temporary file UNIQUE the parameters necessary to construct the punch file that yields the TYPE 2 lead cards to the MODCOMP 4 program BLDCDB. Table 2-VII describes the parameters and their locations in the input and output files for this SELECT run.

After the punch file for the TYPE 2 lead cards has been built, program CURVET is loaded to construct the TYPE 3 lead cards to the MODCOMP 4 program BLDCDB. Input to program CURVET is a card deck containing the MSID's of all the TMS measurements and the temporary disk file TMSCAL written by the third SELECT run. The input card deck is cards 2 through N (sec. 2.1.1) that are used in loading the MSID data base. CURVET reads the input card deck, scans the temporary file TMSCAL for the curve type to append to each MSID, and creates a punch file of MSID versus curve type. The format of the output punch file is described in table 2-IX.

The CYBER system directives inserted in the deck setup control the output listings, file manipulation, and punching output strings.

ORIGINAL PAGE IS  
OF POOR QUALITY

TABLE 2-IV.- SELECT RUN 1

[Downlink, 8-bit meas.]

Field no.	Input char. loc.	Output char. loc.	Format	Description
1	1-10	2-11	A10	MEASUREMENT ID
2	842-844	13-15	A3	DATA TYPE
3	848-849	17-18	A2	NO. BITS
4	45-49	20-24	A5	DATA RANGE HIGH
5	50-54	26-30	A5	DATA RANGE LOW
6	55-62	32-39	A8	UNITS DATA RANGE
7	876-881	41-46	A6	CAL. CURVE TYPE
8	63	48	A1	TEL. LINK ID
9	280	51	A1	DEGREE OF FIT
10	281-364	53-136	A84	COEFFICIENTS (A0-A5)

TABLE 2-V.- SELECT RUN 2

[Downlist, 10-bit meas.]

Field no.	Input char. loc.	Output char. loc.	Format	Description
1	1-10	2-11	A10	MEASUREMENT ID
2	342-344	13-15	A3	DATA TYPE
3	100-101	17-18	A2	NO. BITS
4	45-49	20-24	A5	DATA RANGE HIGH
5	50-54	26-30	A5	DATA RANGE LOW
6	55-62	32-39	A8	UNITS DATA RANGE
7	876-881	41-46	A6	CAL. CURVE TYPE
8	63	48	A1	TEL. LINK ID
9	280	51	A1	DEGREE OF FIT
10	281-364	53-136	A84	COEFFICIENTS (A0-A5)

ORIGINAL PAGE IS  
OF POOR QUALITY

TABLE 2-VI.- SELECT RUN 3

[OI and GPC temperatures]

Field no.	Input char. loc.	Output char. loc.	Format	Description
1	2-136	2-136	A135	SAME A SELECT RUN 1 & 2

TABLE 2-VII.- SELECT RUN 4

[Format TYPE 2 lead cards]

Field no.	Input char. loc.	Output char. loc.	Format	Description
1	41-46	1-6	A6	CURVE TYPE
2	51	8	A1	DEGREE OF FIT
3	53-61, 64-66	9-20	A12	COEFFICIENT (A0)
4	67-75, 78-80	21-32	A12	COEFFICIENT (A1)
5	81-89, 92-94	33-34	A12	COEFFICIENT (A2)
6	95-103, 106-108	45-56	A12	COEFFICIENT (A3)
7	109-117, 120-122	57-68	A12	COEFFICIENT (A4)
8	123-131, 134-136	69-80	A12	COEFFICIENT (A5)

### 2.5.1.1 Input

The input to the CYBER 74 job string are the MMDB calibration tapes, downlink and downlist. The deck setup described in table 2-III assumes the input calibration tapes are the RI downlink and downlist calibration tapes. If the IDSD MMDB calibration tape is used, this deck setup must be modified to extract downlink calibrations from file 2 and downlist calibrations from file 4. This change affects only SELECT runs 1 and 2.

Also input to this CYBER run string is the card deck (cards 2-N) that is input to the program that builds the MSID data base. A card with the characters END in columns 1 through 3 must be appended to this deck as a terminator card.

Each of the SELECT runs requires a set of lead cards. A complete description of the preparation of these cards can be found in reference 6, section 4.4.3.

### 2.5.1.2 Output

The output from the CYBER 74 job string is the TYPE 2 and TYPE 3 lead card decks that are later used as input to the MODCOMP 4 program BLDCDB. The formats of the TYPE 2 and TYPE 3 lead cards to BLDCDB are described in tables 2-VIII and 2-IX. A MODCOMP 4 EOF card is punched after each of the TYPE 2 and TYPE 3 decks.

Listings are produced on the standard output device to aid in determining the validity of the output deck.

### 2.5.1.3 Diagnostic Error Messages

'NUMBER TMS MEAS. ON CAL. TAPE EXCEEDS LIMIT OF XXXXXX'

The number of measurements in file TMSCAL exceeds the limit causing a table overflow. This diagnostic causes the program execution to abort and card deck will not be produced. Internal program tables must be expanded before these calibration tapes can be processed.

TABLE 2-VIII.- BLDCDB TYPE 2 LEAD CARD

Field no.	Card columns	Format	Description
1	1-6	A6	CURVE TYPE
2	8	I1	DEGREE OF CURVE FIT
3	9-20	E12.6	Coefficient (A0)
4	21-32	E12.6	Coefficient (A1)
5	33-44	E12.6	Coefficient (A2)
6	45-56	E12.6	Coefficient (A3)
7	57-68	E12.6	Coefficient (A4)
8	69-80	E12.6	Coefficient (A5)

TABLE 2-IX.- BLDCDB TYPE 3 LEAD CARD

Field no.	Card columns	Format	Description
1	1-10	A10	MSID
2	11-12	A2	RATE
3	16-21	A6	CURVE TYPE
4	26-35	A10	MSID
5	36-37	A2	RATE
6	41-46	A6	CURVE TYPE
7	51-60	A10	MSID
8	61-62	A2	RATE
9	66-71	A6	CURVE TYPE
10	76-80	A5	SEQUENCE NUMBER (ascending)

ORIGINAL PAGE IS  
OF POOR QUALITY

#### 2.5.1.4 CYBER 74 Program File Definition

Programs UNIQCL and CURVET may be accessed with the following attach cards:

```
ATTACH(UNIQCL/UN=DRC007,M=R)
ATTACH(CURVET/UN=DRC007,M=R)
```

It is suggested that these files be copied into the Data Processing and Analysis library of absolute programs for production use.

#### 2.5.2 CDB MODCOMP 4 Processing

This task on the TMS Host Computer utilizes the cards output by the CYBER 74 run string to construct the CDB on disk storage. The CDB, which requires 1 track of disk storage, is addressed as logical file 23.

This program reads the TYPE 1 lead card and outputs this information to the header record. The TYPE 1 lead card contains 80 alphanumeric characters of header information identifying this unique CDB. Next the TYPE 2 cards are input with internal program tables being constructed of curve type versus index to location of actual coefficients in the CDB. Then the TYPE 3 lead cards are input, matched with curve type, and a pointer to the coefficients is stored in the index portion of the CDB corresponding to location in MSID. If the curve type for a particular MSID is blank or not defined, the pointer to the coefficients for this MSID is set to the curve where engineering units equals counts (coefficients = 0, 1).

This program assumes that standard calibrations or several measurements use the same curve type. A maximum limit of 200 curve types is established to calibrate the 800 TMS measurements. All TMS measurements must be calibrated by a polynomial curve fit of the fifth degree or less.

##### 2.5.2.1 Input

The MODCOMP 4 program BLD CDB constructs the CDB from an input card deck. This card deck contains card types 1, 2, and 3. The TYPE 1 lead card is a header card containing up to 80 characters of information used to identify this particular CDB. The character string is written directly to the CDB logical file 23, track 0, sector 0 (Header Record).

The TYPE 2 lead cards contain the calibration coefficients for each unique curve type. Table 2-VIII defines the contents of the TYPE 2 lead cards.

The TYPE 3 lead card essentially assigns a particular curve type to each TMS measurement in the MSID data base. Table 2-IX defines the contents of the TYPE 3 lead cards.

#### 2.5.2.2 Output

The output from program BLDCDB is the CDB written on disk logical file 23. Track 0, sector 0 contains the header record used to identify this particular CDB. The calibration information which starts in Track 0, Sector 1 is detailed in figure 2-2. Only one CDB is stored on mass storage, whenever a new CDB is built it destroys the existing one. The existing CDB on disk storage remains intact until program BLDCDB determines that the new CDB being constructed during this execution has been completed with no errors, then the new CDB is written to disk and the previous CDB destroyed.

This program outputs a listing on the standard output device that tabulates the calibrations for each measurement. This listing should be analyzed by the TMS Data Manager and the SMD Data Analysis Coordinator to ensure validity of the CDB.

#### 2.5.2.3 Diagnostic Error Messages

- a. 'ERROR - CAL. COEFFICIENT CARDS EXCEED BUFFER LENGTH, PREVIOUS CARD SKIPPED'

The program limits the number of unique curve types to 200. This limit has been exceeded by the previously listed card which is skipped, execution continues but new CDB will not be output to disk (previous CDB still intact).

- b. 'ERROR - PREVIOUS CARD SKIPPED'

An error has been detected on previous card. That card has been skipped and run continuing with error flag set to inhibit writing new CDB to disk.

- c. 'DIAGNOSTIC - SEQUENCE ERROR PREVIOUS CARD'

Sequence number not in ascending order, error switch set inhibiting CDB from being output to disk. Processing continues with rest of deck.

- d. 'DIAGNOSTIC - POINTER OVERFLOW - MEAS. NO XXXXXXXX CURVE TYPE  
XXXXXX RATE XX COUNT XXXX'

Limit of 60 medium or 740 low/high rate measurements has been exceeded. This measurement is skipped, error switch is set to inhibit output of new CDB, then run continues.



WORD  
(32-bit)

1	POINTER TO CALS. 1ST MEAS. IN MSID	POINTER TO CALS. 2ND MEAS. IN MSID
2	POINTER TO CALS. 3RD MEAS. IN MSID	POINTER TO CALS. 4TH MEAS. IN MSID
3	POINTER TO CALS. 5TH MEAS. IN MSID	POINTER TO CALS. 6TH MEAS. IN MSID
*		
*		
*		
*		
400	POINTER TO CALS. 799TH MEAS. IN MSID	POINTER TO CALS 800TH MEAS. IN MSID
401	NUMBER COEFFICIENTS 1ST UNIQUE CURVE TYPE <sup>2</sup> (INTEGER)	
	COEFFICIENT A(0) 1ST CURVE TYPE (FL. POINT)	
	COEFFICIENT A(1) 1ST CURVE TYPE (FL. POINT)	
	:	
	:	
	COEFFICIENT A(N) 1ST CURVE TYPE (FL. POINT)	
	NUMBER COEFFICIENTS 2ND UNIQUE CURVE TYPE (INTEGER)	
	COEFFICIENT A(0) 2ND CURVE TYPE (FL. POINT)	
	COEFFICIENT A(1) 2ND CURVE TYPE (FL. POINT)	
	:	
	:	
	COEFFICIENT A(N) 2ND CURVE TYPE (FL. POINT)	
	:	
	:	
	NUMBER COEFFICIENTS 200TH UNIQUE CURVE TYPE <sup>3</sup> (INTEGER)	
	COEFFICIENT A(0) 200TH CURVE TYPE (FL. POINT)	
	COEFFICIENT A(1) 200TH CURVE TYPE (FL. POINT)	
	:	
	:	
	COEFFICIENT A(N) 200TH CURVE TYPE (FL. POINT)	
	CALIBRATION FOR MEAS IN NUMBER COEF. = 2	
	MSID THAT HAVE NO CURVE COEFFICIENT A(0) = 0	
	TYPE (SET ENGINEERING UNITS = COUNTS) COEFFICIENT A(1) = 1	
1803	:	
	:	
	:	

ORIGINAL PAGE IS  
OF POOR QUALITY

<sup>1</sup>16-bit integer pointer addressing calibration coefficients  
for each measurement in MSID. (Pointer to first curve type = 1)

<sup>2</sup>Each unique curve type encountered for 8-bit downlink and 10-bit  
downlist temperature measurements on input calibration tapes in-  
cluded in table.

<sup>3</sup>200 unique curve types maximum, if less tables are contiguous and  
last words in table not used.

Figure 2-2.- Calibration data base description.

- e. 'DIAGNOSTIC - NO MATCH FOUND FOR CURVE TYPE XXXXXX  
CALIBRATION SET TO ENGINEERING UNITS = COUNTS'

Curve type for a measurement on card not in input deck of curve type versus coefficients. Calibration set to engineering units = counts (coefficient = 0, 1). CDB will still be written to disk at end of run.

- f. 'ERRORS ENCOUNTERED DURING EXECUTION - CAL. DB NOT WRITTEN TO DISC'

An error has occurred causing validity of CDB to be questionable; therefore CDB not written to disk (LU23). Previous CDB on disk still valid.

- g. 'NO ERRORS CAL. DB WRITTEN TO DISC - LU23'

New CDB constructed with no errors. New CDB overlays previous CDB on disk Logical Unit 23.

## 2.6 LOADING PREDICTED/PAST MISSION DATA BASE

The loading of the Predicted and Past Mission data bases actually consists of three separate tasks on the MODCOMP: (1) conversion of predicted mission data from UNIVAC to MODCOMP codes, (2) archiving of mission data to be used as a past mission data (described in sec. 2.14), and (3) actual loading of the data from tape to the proper data base on disk. The predicted mission data is supplied by SMD.

All tapes used in this process should be error-free tapes. If the UNIVAC tape is not error free, the conversion task will be terminated. If the MODCOMP tapes are not error free, data for the records in error will be lost unless a backup error free tape can be found. Multiple copies of the tapes should also be maintained. The tapes should be maintained in a file near the computer during a mission.

### 2.6.1 Conversion of Predicted Mission Data

The predicted mission data is generated by SMD in the format specified by ICD ES34-3/78-277. The data is received on a nine-track tape written on UNIVAC equipment. Before it can be used on TMS, the tape must be converted from UNIVAC field data and floating-point numbers to MODCOMP ASCII and floating-point numbers. This function is accomplished by a batch job on the MODCOMP. The job requires the tape from the UNIVAC equipment as input. A tape in MODCOMP acceptable characters and numbers is output. All files on the input tape are processed until a double EOF is encountered. This MODCOMP tape is used as input to loading the predicted mission data base.

### 2.6.2 Input

The inputs to the predicted and past mission data bases are tapes. The tapes contain a header record and data record(s) for each rate data (low, medium, or high). The header record contains mission ID, data ID information, times to be associated with data, and parameter names for all the parameters in the file. The data records contain the data values in engineering units in floating-point numbers. The time of a data value can be determined by the start of data time in the header record and the position of the data value in the data record. The data records are in the same format as the data is stored on the disk. The data records are in the same order as the parameter names in the header record. If there is no valid data value for a specific time then a fill pattern is in the data value. The low-rate file contains one record per parameter. The medium-rate file contains two records per parameter. The high-rate file contains three records per parameter. A double EOF or invalid information in the header record terminates a tape.

### 2.6.3 Output

The output of this task is the Predicted or Past mission data base. The data base and file in that data base is determined from information in the header record of each file. The parameter data record(s) are output to disk in the same order as the parameter names appear in the MSID data base. If a parameter is in the header record but not in the MSID data base, then the data record(s) for this parameter are skipped. If a parameter is in the MSID data base but not in the header record, then the data values in the data base are stored as fill pattern. If an unrecoverable parity error is detected on a data record, then the data values for the time interval that the record is supposed to cover are stored as fill pattern. Global common is also updated to reflect pertinent information extracted from the last header record on a tape. The high-rate data pointer table in the MSID data base is also updated.

### 2.6.4 Informational/Error Messages

The following messages are output to the printer by the conversion of predicted data task:

a. 'EOF READING HEADER - TERMINATED'

This is the normal termination message since there is no specification of the number of files on tape. Either the first record on tape was an EOF or a double EOF was detected.

ORIGINAL PAGE IS  
OF POOR QUALITY

b. 'UNRECOVERABLE ERROR ON TAPE READ'

Unreadable header record on UNIVAC tape, task terminated. The UNIVAC tape must be readable without error on the MODCOMP.

c. 'INVALID RATE IN HEADER'

The data rate specified in the header record of the UNIVAC tape was not LOW, MED, or HIGH. Task is terminated.

d. 'EOF SKIPPING TIME WORDS'

An EOF was detected on the UNIVAC tape while skipping over the time words of a file. Task is terminated.

e. 'EOF OR BAD READ ON INPUT'

An EOF or read error on a data record. The task is terminated. The UNIVAC tape must be readable without error on the MODCOMP.

f. 'NO EOF AFTER XXXX RATE DATA'

Where XXXX = LOW, MED, or HIGH. There is supposed to be an EOF after each data file on the UNIVAC tape. This condition was not detected and the task is terminated.

Other informational messages are output to the printer after a file has been successfully processed. These messages give information from the header record of the file.

The following messages are output by the task that actually loads the predicted or past mission data bases using the MODCOMP acceptable tape as input. Parts of data bases on disk have probably been destroyed when any message except r. is printed unless the error occurred on first record of tape.

a. 'HEADER RECORD ERROR ON TAPE - JOB TERMINATED'

EOF or read error detected on header record. Probably wrong tape input or tape has been damaged.

b. 'DATA TYPE OR RATE IN HEADER RCD INVALID'

Valid read for header record but not expected information in record. Probably wrong tape input.

c. 'UNRECOVERABLE ERROR ON TAPE READ'

Something has probably gone bad with the tape unit. Probably will work on a different unit.

d. 'TOO MANY XXXX RATE PARAMETERS'

Where XXXX is LOW, MED, or HIGH. Limits are 740 low, 60 medium, and 150 high.

e. 'NO EOF AFTER ALL XXXX RATE PARAMETERS'

Where XXXX is LOW, MED, or HIGH. No EOF was detected on input tape after the specified number of parameter records was read from the file. Probably hardware error or tape has been destroyed.

f. 'NO FILES OUTPUT - CHECK INPUT TAPE'

Error was detected on input tape before any data was output to disk.

g. 'ZZZZ PARITY ERRORS IN XXXX RATE FILE'

Where ZZZZ is number of parity errors detected on reads and XXXX is LOW, MED, or HIGH. This message is output after each

file is loaded. The fill pattern is inserted in the data base for the parameter values where the record should go. Any parity errors will probably be unacceptable so it will probably be necessary to try the backup tape if there is one.

Other informational messages are also output to the printer after a file has been successfully loaded. These messages give information from the header record of the file.

ORIGINAL PAGE IS  
OF POOR QUALITY

## 2.7 INITIALIZATION OF TIMES AND CURRENT MISSION DATA BASES

Before mission data can be processed mission ID and times for processing data must be established. This information is input by card. The current mission data base which consists of the Data Directory and the Current Mission low/Medium Rate data bases must also be initialized. Data flags indicating no data for every time slot for every parameter are set in the low/medium rate data base. All entries in the data directory are zeroed and only necessary data words are left in the data base.

This task must be executed prior to processing the first NIP CCI for a specified start of data time. It is expected that this task will be executed twice for a mission. The first time the task is executed a start of accepting data time for processing prelaunch data and expected launch time is anticipated and the second time the task is executed a start of accepting data time for processing data after launch and actual launch time with launch and start data time equal is anticipated.

The data manager must supply the computer operator with a card containing the desired times and information to execute the task.

### 2.7.1 Input

The input to this task is a card. Different fields on the card specify options for the task and times for data processing. The format of the card is as follows:

<u>Column</u>	<u>Description</u>	
1-8	Mission ID An 8-character mission ID to be used on all display formats.	
11-12	Month <sup>1</sup> to start accepting data	
15-16	Day <sup>1</sup> to start accepting data	
19-20	Year <sup>1</sup> to start accepting data (last 2 digits only)	
23-24	Hour <sup>1</sup> to start accepting data	
27-28	Minute <sup>1</sup> to start accepting data	
31-32	Second <sup>1</sup> to start accepting data	ORIGINAL PAGE IS OF POOR QUALITY
35-36	Month of launch <sup>2</sup>	
39-40	Day of launch <sup>2</sup>	
43-44	Year of launch <sup>2</sup> (last 2 digits only)	
47-48	Hour of launch <sup>2</sup>	
51-52	Minute of launch <sup>2</sup>	
55-56	Second of launch <sup>2</sup>	
59-60	Current mission low/medium rate data base initialization flag = NO - Do not initialize data base to fill pattern. ≠ NO - Initialize data base to fill pattern.	
63-64	Current mission data directory initialization flag = NO - Do not initialize data directory ≠ NO - Initialize data directory (destroy all entries)	

<sup>1</sup>Dates and times must be in Greenwich Mean Time. All the time fields are expected to be integers. Very limited checking is done on the time fields; therefore, the printer output of these times should be verified.

<sup>2</sup>Launch time is actual lift-off time if known. If processing prelaunch data, then launch time will be an expected lift-off time.

## 2.7.2 Output

The output of this task is an updated mission ID, a start of accepting data time, and launch time in the MSID data base. This information is also inserted in the global common block. If specified by option, the current mission low- and medium-rate data files are set to a fill pattern on disk. This means all previous data in those files are destroyed. If specified by the other option, the Data Directory data base is set to all zeroes except two words of a specific track used by NIPP. Information is also output to the printer specifying the task's interpretation of information input by the lead card.



### 2.7.3 Informational/Error Messages

The following informational or error messages may be output by the task to the printer.

a. 'NO INPUT CARD OR MONTH OR DAY TO START DATA INVALID'

The card read by the task was an EOF card, the month was not 1 through 12, or the day was not 1 through 31 specified in the start of accepting data time. No changes are made to any data base.

b. 'MONTH OR DAY OF LIFT-OFF INVALID'

The month was not 1 through 12 or the day was not 1 through 31 as specified in the launch time. No changes are made to any data base.

c. 'JOB COMPLETE'

Normal termination message. The task has updated the #SID data base and global common. The low/medium and the Data Directory data base have been initialized if requested.

## 2.8 PROCESSING NIP/STCS DATA

Program NIPP is the task that assumes sole responsibility of interfacing the TMS with the downlist/downlink flight data in a near real-time mode. All required current mission flight data is input by this task to the TMS via the disk working file. The capability of this program includes: (1) loading and extracting time-correlated TMS measurements from the NIP/STCS data tapes, (2) reloading into the disk working file intermediate data tapes for requested high-rate load groups, and (3) restoring to the working file intermediate data tapes when required by a disk or system anomaly. Each of these major functions is detailed in the following sections.

### 2.8.1 NIP/STCS Tape Processing

When a NIP/STCS CCT is received by the TMS for processing, this function will be performed by program NIPP. This task is initiated via the console typewriter by the following request:

NIP "XXXXXXXXXX", TMS "YYYYYY"

where XXXXXXXXXXXX is the 10-character NIP accession number, and YYYYYY is the 6-character TMS intermediate reel number.

This program retrieves all TMS measurements from the NIP/STCS CCT for each data cycle and store these data plus time on the disk working file.

The amount of data on each NIP/STCS CCT is described in the index file (File 1) by CDS. NIPP utilizes the information in this file to allocate the storage required in the disk working file to store the data contained in the data file (File 2) of this tape. The CDS's in the index file are also used to construct the temporary CDS(s) describing the TMS data for this tape in the Current Mission Data Directory data base. These CDS's describe the continuous data segments. Any of the following conditions cause a new CDS to be created:

- a. Beginning of NIP/STCS tape
- b. Data gap of over 30 seconds
- c. Change in OI format
- d. Change in data source
- e. Change in data input mode

After the index file (File 1) has been processed and the allocation of the disk working file has been performed, processing of the data file is initiated.

File 2 data records are input and the OI and GPC formats are reconstructed for a complete data cycle (1 second of data). Then by using the STDB (sec. 2.4) the TMS measurements are extracted

and inserted in the TMS logical output record. The TMS logical record contains time and the 800 TMS measurements in an order specified by the MSID data base. The TMS logical record is time tagged with the time associated with the OI format for this data cycle. When six logical TMS records are accumulated, they are output to the working file. This procedure continues until the end of tape record is encountered.

Then the CDS's in the temporary file of the Current Mission Data Directory data base are copied to the TMS intermediate data tape followed by the data records in the working file.

This program terminates by typing 'END NIP' on the typewriter and calling the TMS overlay processor to load program LMU, which updates the low- and medium-rate data bases.

#### 2.8.1.1 Input

Input to this task is the NIP or the STCS CCT's. These tapes are the same tapes that are used by the IES on the CYBER 74 computer for Shuttle data processing. The NIP data tapes are input to the TMS by GDSD. The format of the NIP data tape is described in reference 2.

The STCS data tapes are written by the STCS from downlink/downlist instrumentation tapes. The format of the STCS CCT is described in reference 3.

#### 2.8.1.2 Output

ORIGINAL PAGE IS  
OF POOR QUALITY

This program outputs the TMS data from the NIP/STCS CCT to the working file. Output to the working file is blocked to track size buffers, each containing 6 seconds of TMS data. A TMS logical record is constructed for each data cycle on the input NIP/STCS CCT. Each logical record contains time and data values for the 800 TMS measurements.

This program outputs the TMS internal CDS's describing the data that NIPP has just put in the working file. These CDS entries are put in the temporary track (Track 7) of the Current Mission Data Directory Data Base. This track is used as temporary storage of CDS entries between the NIPP, the Low/Medium Rate Update Program, and the directory update program. Also stored in this track of the Current Mission Data Directory Data Base is the list of NIP/STCS tapes that are on-line in the working file.

A listing is produced on the output printer tabulating the standard overhead and the OI CDS entries contained in the index file of the NIP/STCS CCT. The STDB summary described in section 2.4.2 is output. The output listing on the printer includes a summary of the working file disk allocation and a NIP/STCS tape processing summary described in figure 2-3. The CDS entries

described in figure 2-3 are the internal CDS's that may be compressed to eliminate data gaps of less than 30 seconds.

# NIP DATA TAPE PROCESSING OUTPUT SUMMARY

MISSION IDENTIFICATION NO. - 15  
 DATE TAPE PROCESSED. - 10/31/1978 TIME (HR:MN:SC)- 9:18:32  
 NIP CCT. ID. NUMBER - 996  
 NIP CCT. ACCESSION NUMBER - C492000022  
 TMS CCT. IDENTIFICATION NO. - X03185  
 DISK STORAGE:

INITIAL TRACK ADDRESS - 811  
 NUMBER TRACKS REQUIRED- 216

## CDS SUMMARY THIS TAPE:

INITIAL CDS NUMBER - 9  
 NUMBER CDS - 3

2-44

CDS NO	NO LQO. RECORDS	TRACK ADDR	SECTOR ADDR	FLT. ID. NO	DATA IMP CODE	FORMAT NO	BFD SITE ID	START TIME DAYS	HR	MIN	SEC	TIME INTERVAL (SECONDS)
9	217	811	0	15	50	129	0	185	13	13	13	217
10	766	847	7	15	50	129	0	185	13	24	11	766
11	309	974	35	15	50	129	0	185	13	39	46	309

NCDS= 3 LCDS= 11 NDTLOC= 5 NDTLOC PTR= 5

WORKING FILE TAPE WRITTEN - 1296 RECORDS

END NIPP

\$\$

Figure 2-3.- NIP/STCS tape summary.

ORIGINAL PAGE IS  
OF POOR QUALITY

### 2.8.1.3 Diagnostic Error Messages

'TASK NOT INITIALIZED, RELOAD TASK'

Operator in loading this task via typewriter did not type in NIP accession number, reload task NIP "XXXXXXXXXX", TMS "XXXXXX".

'NIP ACCESSION NO. NOT VALID, CORRECT AND RELOAD TASK'

Accession number input via typewriter is invalid, correct and reload.

'TMS TAPE NO. NOT VALID, CORRECT AND RELOAD TASK'

Intermediate tape number input via typewriter invalid, correct and reload.

'NIP INPUT TAPE PARITY ERROR - RECORD NUMBER XXXXXX RECORD SKIPPED'

Record XXXXXX unreadable, record is skipped and job continues.

'NIP INPUT TAPE PARITY ERROR - RECORD NUMBER XXXXXX FATAL ERROR JOB TERMINATED'

Status returned to program by tape driver indicates fatal tape error. Retry job with NIP/STCS tape on another tape drive.

'ERROR - CDS ENTRY TABLE OVERFLOW - DATA FILE ENTRYS = XXXXXX INDEX FILE ENTRYS = XXXXXX'

A serious error exists with NIP/STCS input tape. The number of CDS's constructed from data file exceeds number in index file.

'ERROR - OI FMT DATA FILE = XXXXXX OI FMT INDEX FILE XXXXXX'

CDS number discrepancy, data file does not agree with index file, terminates run. Investigate NIP/STCS tape for possible error.

'ERROR - BYTE SEQUENCE - FIRST BYTE = XXXXXX LAST SEGMENT FIRST BYTE = XXXXXX NO. BYTES = XXXXXX'

A discrepancy has occurred in the byte counters used to build the data segment. Run continues but this data cycle is skipped.

'ERROR - FORMAT NO. - XXXXXX NOT ON STDE - (MUST BE SKIPPED)'

Format number XXXXXX is contained on data tape but support table information not in STDB. Run continues but this format will be skipped.

'ERROR - TRACKS REQUIRED = XXXXXX TRACKS RESERVED = XXXXXX'

The amount of data in the data file exceeded space reserved when computed from index file. NIP tape error encountered and the job aborted.

'ERROR EXIT NIPP'

Task has aborted, the condition of the data bases will be exactly like they were when job started, except some space in working file may have been taken off-line.

'NO. WINDOWS (FORMATS) EXCEEDS 5 FOR DATA CYCLE XXXXXX'

There were more than five GPC formats on the NIP/STCS CCT for this data cycle. The sixth format will be skipped and job continues.

'PARITY ERROR - FILE 1, REC XXX NO. TRYS XX'

Index file cannot be read and job aborts. Try tape on another drive. If this condition persists request remake of NIP/STCS tape.

'ABORT NO. CDS ON NIP TAPE = XXXX'

The limit is 200. Too many OI CDS's on NIP tape, segment NIP/STCS tape.

'PROGRAM LMUP MUST BE EXECUTED PRIOR TO NIPP'

The Low/Medium Rate Update Program, LMUP, must be run to process last decommutation run before next run is made. Run LMUP as a batch job or use job sequence to be followed to restore from last disk save.

#### 2.8.2 Reload for High-Rate Data

When the user requests high-rate data plots from data no longer on-line in the working file, it necessitates reloading of the TMS intermediate tape(s). Program LOAD requests the operator to load a specific intermediate tape by tape number and then execute program LDH. This program is initiated from console by typing 'LDH XXXXXX' after tape is mounted. This program reloads the intermediate tape into the working file and updates the current mission data base to reflect this condition.

Program LDH terminates execution by typing 'END LDHR' on the console typewriter and calling TMEXIT to cue the TMS executive that tape number XXXXXX has been loaded.

### 2.8.2.1 Input

Input to LDH is the TMS intermediate tape that is output when the NIP/STCS CCT was processed. The format of this tape is described in section 2.8.1.

### 2.8.2.2 Output

The data contained on the intermediate tape is copied into the working file and the current mission data base is updated to indicate this action. If the working file was full when this request was input, other data previously stored in the working file is automatically taken off-line to make space available for this request.

Also output by this task will be a formatted report on the printer briefly describing the input tape, its contents, and CDS's in the current mission data base for this tape. Figure 2-3 is an example of this report.

### 2.8.2.3 Diagnostic Error Messages

'FATAL PARITY ERROR - REC. = XXXX FILE XX'

The status from the tape driver indicates a fatal error on input tape. Mount tape on another drive, if condition persists the final recourse is rerunning NIP/STCS tape.

'REC. COUNT EXCEEDS LIMIT - NO. REC = XXXX LIMIT = XXXX'

Record count on intermediate tape exceeds limit established in CDS. Fatal error program aborts, check input tape.

'CDS ERROR - NDB (XXX) = XXXX NCDST (XXX) = XXXX'

Fatal error, the CDS on tape does not agree with the current mission data base, call programmer.

'TASK NOT INITIALIZED, RELOAD TASK'

Operator did not type in tape number to be loaded; retype load request for task LDH, TMS 'XXXXXX' or RES, TMS 'XXXXXX'

### 2.8.3 Restore Intermediate Data

In case of a system or disk anomaly when the system data bases are destroyed, the capability of recovering is included in the TMS. Program RLOD (sec. 2.12) reloads the data bases that were saved by the last data base save (sec. 2.11). RLOD modifies the current mission data base pointers to indicate that no data is on-line in the working file. Then program RES is initiated via the console typewriter along with the intermediate tape number to



be restored to the disk working file. RES reloads the specified tape into the working file and builds CDS records in the temporary portion of the current mission data base.

Program RES terminates execution by typing 'END RESTORE' on the console typewriter and calling TMLDOV to overlay RES with the low- and medium-rate update program LMU.

Program RES should be executed again and again until all intermediate tapes decommutated by NIPP since the last data base save have been restored to the working file. The intermediate tapes must be reloaded in the order they were decommutated. If an intermediate tape is lost or unreadable, the data must be decommutated again from the NIP/STCS CCT before the remaining intermediate tapes to be restored can be processed into the working file.

#### 2.8.3.1 Input

Input to RES is the TMS intermediate tape that is output when the NIP/STCS CCT was processed. The format of this tape is described in section 2.8.1.

#### 2.8.3.2 Output

The data contained on the intermediate tape is copied into the working file and the current mission data base is updated to indicate this action. If the working file was full when the request was input, the data previously stored in the working file had to be removed or taken off-line to make space available for this request.

Output by this task will be a formatted report on the printer briefly describing the input tape, its contents, and CDS's in the current mission data base for this tape.

#### 2.8.3.3 Diagnostic Error Messages

The diagnostic error messages for RES are the same as those listed in section 2.8.2.3 for LDH.

## 2.9 UPDATING LOW/MEDIUM RATE DATA AND DATA DIRECTORY

Updating the low/medium rate data consists of computing the times to select the data for the different rates, selecting the data values based on status and within tolerance of the computed times, calibrating the selected data values, and updating the data base. The NIPP task overlays the low/medium rate update task and it in turn overlays the data directory update task. The entries to the data directory are added as they are received but entry number and times are extracted and a table of times, sorted chronologically by entry start time, is also maintained in the data directory data base.

These tasks are not stand-alone tasks and can be executed only by a NIPP task.

### 2.9.1 Input

**ORIGINAL PAGE IS  
OF POOR QUALITY**

The input to these tasks are the output of the NIPP task and the Current Mission Low/Medium Rate data base, the data directory, and the CDB. The new data extracted from the NIP CCT is assumed to be in the working file of the disk and the new data directory entries on the temporary storage track of the Data Directory data base. No computer operator functions are required for these tasks and no cards are read.

### 2.9.2 Processing

Since the input data to the low/medium rate update task is at one sample/sec, the data must be filtered to the desired rate. The low-rate data is filtered to 1 sample every 10 minutes and the medium rate is filtered to 1 sample every 2 minutes. The computed times to select data values are at start of accepting data time and every 2 or 10 minutes from then up to a limit of 179 hours for a mission. The data values for a computed time are selected from a data cycle within a specified tolerance of the computed time. The tolerance for the low-rate data is plus or minus 1 minute and for the medium-rate data the tolerance is plus or minus 15 seconds. A complete data cycle is defined as a data cycle when all minor frames that were used to make up the data cycle were acceptable by the NIP. An incomplete data cycle is defined as a data cycle when at least one minor frame of the data cycle was not acceptable by the NIP. If complete data cycles are found within the specified tolerance of the computed time, then data is extracted from the data cycle nearest the computed time. If no complete data cycle is found within the specified tolerance, then data is extracted from the incomplete data cycle nearest the computed time but within the specified tolerance. If no complete or incomplete data cycle is found within the specified tolerance of the computed time, then no data is extracted for that computed time. The data extracted for the

computed times is calibrated and stored in the data base based on time.

In the data directory the new entries are added to the ones already in the data base. Start times, entry number, and time interval are extracted from the new entries and sorted by start time with all previous entries and the sorted file of the data directory is updated.

### 2.9.3 Output

The output of this task is an updated Current Mission Low/Medium Rate data base and an updated data directory. The data in the low/medium rate data base is calibrated and in floating point.

### 2.9.4 Informational/Error Messages

One of the following messages is output to the printer upon completion of the low/medium rate update task:

a. 'LOW/MEDIUM RATE FILES UPDATED'

The low/medium rate data base on disk has been updated.

b. 'NO LOW/MEDIUM DATA TO UPDATE'

No data was found within the specified limits of the computed times for low/medium rate data or data was out-of-mission range.

c. 'TOO MANY PIGEON HOLES IN A CDS'

More than 500 medium-rate or 100 low-rate times were computed to store data from a NIP tape. The computed points are updated and the processing is terminated.

The following messages may be output by the data directory update task:

a. 'DATA DIRECTORY UPDATED'

Normal termination of task.

b. 'DATA DIRECTORY FULL'

In the process of updating the data directory, the limits of the data base was exceeded. There is a limit of 1343 entries in this data base. No more CCT's can be processed.

- c. 'TOO MANY NEW ENTRIES = XXXX MAX OF 200'

Where XXXX is the number of new entries from the NIPP task. Task is terminated without updating data directory. This message should never occur without hardware failure since the NIPP task also checks this limit.

- d. 'REPEATED ENTRY NUMBERS - DATA DIRECTORY NOT UPDATED'

NIPP task put redundant entries numbers in temporary storage track or hardware failure. Entry numbers must be unique. Call programmer for analysis.

- e. 'NO. NEW ENTRIES = X PROGRAM TERMINATED'

Where X is the number of new entries. The number of new entries received from NIPP task was either negative or zero. The task must have been activated without the NIPP task getting activated.

- f. 'DISCONTINUITY BEFORE NEW ENTRIES - NOT UPDATED'

The first new entry number is not equal to the last entry number plus the one received from the NIPP task. Possible disk or machine problem.

ORIGINAL PAGE IS  
OF POOR QUALITY

## 2.10 UPDATING CURRENT MISSION HIGH-RATE BASES

Updating the Current Mission High-Rate data base is an interactive task activated only from a terminal. Each terminal is assigned a file of 20 tracks in the data base and only that terminal can access that file.

The terminal user requests a load group and a time interval. The task extracts the load group information from the High-Rate Load Groups data base. The CDS's covering the desired time interval are extracted from the data directory. If the data for a selected CDS are in the working file, the desired data is extracted and maintained in a buffer in memory by parameter. If the data for any selected CDS is not in the working file, the data already extracted is output to the terminal's private high-rate file. The TMS intermediate tape containing the CDS is requested to be loaded to the working file by program LDH and the task exits with a 'waiting an event' state. Once the data is loaded in the working file, the TMS monitor reactivates the task. Upon reactivation the task reads the data output to the terminal's private file. The data is extracted from the CDS's added to the working file by LDH. After the data is extracted for all CDS's, the CDB is input, all data values are calibrated and output to the terminal's private file by parameter. If no data is found for a time slot, the 'no data flag' is inserted in that slot. If redundant data is found for a time slot, the last value extracted will be in that slot.

### 2.10.1 Input

The input to this task is a command from the user at the terminal. Reference 1 contains instructions for the command. The data base information is input from the following data bases:

- a. High-Rate Load Groups
- b. Data Directory
- c. Working File
- d. Terminal's private file (only if data has to be restored to working file)
- e. Calibration

The mission launch time is taken from global common. It is necessary since a mission elapsed time from launch is input by the user.

### 2.10.2 Output

The output of this task is the calibrated data for the desired load group for the requested time interval to the terminal's private file. There is a maximum of 20 parameters per load group and a maximum time interval of 30 minutes. The data output is at one sample/sec and sorted by parameter. If no valid data is found for a time slot for a parameter that slot will be a fill pattern.

### 2.10.3 Informational/Error Messages

The following message may be output at the console (Silent 700) during execution of the task:

'\*\*MOUNT TAPE A THEN INITIATE PROGRAM LDH\*\*'

Where A is the TMS intermediate tape number extracted from the CDS entry in the data directory. The computer operator should mount the requested tape and then execute the requested program.

The following messages may be output at the printer during execution of the task:

a. 'ENTRY X FOUND WHERE Y SHOULD BE'

Where X and Y are entry numbers in the data directory. Entry number and position in the data directory must agree. Data for entry Y is ignored and the task continues. Something has happened to the data directory and will probably have to be corrected with a reload.

b. 'X TRACKS ASSIGNED TO FILE Y MUST BE AT LEAST 20 TRACKS ASSIGNED'

Where X is the number of the track assigned to file Y in the monitor. Each graphics terminal must have a disk file assigned with a minimum of 20 tracks.

c. 'INVALID RE-QUE OF THIS TASK - LOD'

Something has probably gone wrong with the computer or monitor. Certain information is expected in the terminal's private file upon a monitor re-que after an execution of program LDH. The information in the private file is not as expected. Task terminates.

ORIGINAL PAGE IS  
OF POOR QUALITY

The following messages may be output to the printer and to the user's terminal during execution of the task:

a. '\*\*\*\*LOAD GROUP X LOADED\*\*\*\*'

where X is the high-rate load group number. Normal termination message and data is ready for display.

b. 'TIME INTERVAL REQUESTED GREATER THAN 30 MINUTES'

The time interval requested by the user was greater than 30 minutes.

c. 'INVALID LOAD GROUP NO. 1 THROUGH 99 VALID'

The load group number requested by the user was not 1 through 99.

d. 'LOAD GROUP X NOT DEFINED'

Where X is the high-rate load group number requested by the user. That high-rate load group has not been defined in the high-rate load group data base.

e. 'NO DATA FOUND WITHIN REQUESTED INTERVAL'

No entries were found in the data directory covering any of the requested time interval by the user.

f. 'INVALID TERMINAL REQUESTED - LOD'

The valid terminal numbers are 1 through 8. The terminal identification received by the task was not 1 through 8.

ORIGINAL PAGE IS  
OF POOR QUALITY

## 2.11 SAVING OF DYNAMIC DATA BASES

Periodically during a mission (recommended at least every 8 hours) certain data bases should be saved on tape to guard against system failure. The Display Formats, Data Directory, and Current Mission Low/Medium Rate data bases are being updated continually during the mission. It would be prohibitive to go back and build these data bases from the original input data. Some other data bases are saved for convenience. The computer time required is minimal and it would be easier to reload the data bases from this tape instead of execution of the task that built the data base.

Error-free tapes (certified tapes with zero errors) should be used for this task since it may be necessary to use this tape to restore the data bases after a system failure or a reconfiguration. The following is a cross-reference of the tape file, disk file, and data base:

<u>Tape file</u>	<u>Disk file</u>	<u>Data base</u>
1	21	MSID
2	22	High-Rate Load Groups
3	23	Calibration
4	24	Support Table
5	25	Display Formats
6	30	Data Directory
7	33	Current Mission Medium-Rate Data
8	36	Current Mission Low-Rate Data

ORIGINAL PAGE IS  
OF POOR QUALITY.

### 2.11.1 Input

The input to this task are data bases already on the disk. No lead cards or computer operator inputs are required except the operator must specify the tape unit the data is to be written to. The following data bases are input and should not be in the process of being updated at the time:

- a. MSID
- b. STDB
- c. CDB
- d. High-Rate Load Groups
- e. Display Formats<sup>1</sup>
- f. Data Directory
- g. Current Mission Low/Medium Rate

<sup>1</sup>If changes are being made at a user terminal to a display format when the data base is read, those changes will not be on the output tape.



### 2.11.2 Output

The output of this task is a tape containing a header record and track size data records for all data in each data base. Each data base is contained in a separate tape file and the logical file number on disk the data came from is in the header record. The Current Mission Low/Medium rate data base is written to two files on the tape with the low-rate data in one file and the medium-rate data in the other.

### 2.11.3 Informational/Error Message

Only one message is output at the console (Silent 700) by this task upon its completion. Any tape problems are handled by the system monitor but only the best tapes should be used as this tape may have to be used to restore the data bases.

'FILES 21 THRU 25 AND FILES 30, 33 & 36 COPIED TO TAPE'

Normal termination message where the file numbers are the disk file numbers.

## 2.12 RELOADING OF DYNAMIC DATA BASES

Reloading of these data bases will only be necessary in case of a system failure or reconfiguration. The system failure may be a hardware failure in the computer or on the disk; a software failure of the monitor, one of the errors detected in the data directory update task; or a software problem not detected during testing. The latest tape saved by the task defined in section 2.11 should be used as input. If errors are detected in certain files of that tape, then you may have to revert to a previously saved tape. All other tasks should be suspended during this operation.

### 2.12.1 Input

The input to this task is the tape output by the task defined in section 2.11. The computer operator is requested to specify the tape unit the tape is on. No other operator or card input is required. All other information necessary to restore the data to disk is in the header record of each file.

### 2.12.2 Output

The output of this task is the restoration of the data bases to the status they were when the tape was made by the task defined in section 2.11. The following data bases are restored:

- a. MSID
- b. STDB
- c. CDB
- d. High-Rate Load Groups.
- e. Display Formats
- f. Data Directory
- g. Current Mission Low/Medium Rate

ORIGINAL PAGE IS  
OF POOR QUALITY

All data bases are just a copy from tape to disk except the Data Directory data base. In this data base the address of the data in the working file is cleared since the working file is not restored. After this task the data directory entries indicate that no data is in the working file.

### 2.12.3 Informational/Error Messages

One or more of the following messages may be output at the console (Silent 700) during execution of the task:

- a. '1st RECORD OF TAPE EOF - MUST BE WRONG TAPE'

The first record read from tape was an EOF. Must be wrong tape or tape unit problem.

- b. 'DEVICE ERROR ON INPUT TAPE - CHECK UNIT - RESTART JOB'

A device error was detected on tape unit.

- c. 'DISC FILE NO. IN HEADER RCD INVALID - TAPE FILE X'

Where X is the tape file number of the invalid disk file number. Must be bad input tape or hardware failure. The specified tape file is skipped and the corresponding disk file remains intact.

- d. 'EOF BEFORE ALL DATA - TAPE FILE X'

Where X is tape file number with not enough data. Must be bad input tape or hardware failure. The program continues with next file but the specified file is probably in error on disk. Message e.) or i.) will also be printed dependent on file at end of run to denote necessary action.

- e. 'ERROR IN A DYNAMIC DATA FILE - MUST REVERT TO A PREVIOUS SAVE TAPE'

Tape error was detected in the data directory file or the current mission low/medium rate data files. Must revert to the previously saved tape since no error should be allowed in these files.

- f. 'NO EOF AFTER EXPECTED NO. RCDS - FILE X'

Where X is the tape file number. Must be bad input tape or hardware failure. The program copies expected number of records to disk, advances past a file mark, and continues with next file.

- g. 'PARITY ERROR IN HEADER RCD - TAPE FILES X, Y, Z...'

Where X, Y, and Z are the tape file numbers that a parity error was detected. Not considered a fatal error since the order of the files on tape is known by the program.

- h. 'PARITY ERROR IN DATA RCDS - TAPE FILES X, Y, Z...'

Where X, Y, and Z are the tape file numbers that parity errors were detected in data records. The data base contained in that file must be reloaded from another source.

- i. 'DISC FILE X MUST BE RELOADED FROM THE LAST PROGRAM LOAD, DUE TO ERROR ON READING TAPE'

Where X is the disk file number that was being loaded when the error occurred. See section 2.11 for a cross-reference

of disk file and data base. Also see specific section for denoted data bases.

- j. 'TAPE RESTORE COMPLETE - CHECK FOR ERROR MESSAGES ABOVE'

Normal termination, but must check for any previous messages to see if other action is required.

- k. 'LAST ENTRY OF DATA DIRECTORY FOLLOWS'

Information from the last expanded CDS is printed following the message.

## 2.13 SLIDING OF CURRENT MISSION LOW/MEDIUM RATE DATE

If for any reason the mission goes beyond 7 days, 11 hours, and 10 minutes, the medium-rate data file has no positions to store data. For this reason this task was developed to remove the oldest data from the current mission low- and medium-rate files, move the remaining data, and store fill patterns at the end of the files to account for the number of hours the data was slid. The start of data time in the MSID data base and in global common is incremented the number of hours the data is slid. Hopefully this task will never have to be executed. If it does have to be executed, decisions will have to be made about archiving data to be used as past mission data.

### 2.13.1 Input

The input to this task is a lead card specifying the number of hours to slide the Current Mission Low/Medium Rate data. Also input from the disk by the task is the Current Mission Low/Medium Rate data base and the start of accepting data time from the MSID data base. The format of the lead card follows:

<u>Column</u>	<u>Description</u>
3-4	Number of integral hours to slide the data. The number must be a positive integer.

### 2.13.2 Output

The output of this task is an adjusted Current Mission Low/Medium Rate data base. The oldest data in time is removed from the data base. Fill pattern is stored at the end of the data base for the number of hours the data was slid. The start of accepting data time in the MSID data base and in global common is adjusted for the number of hours the data is slid.

### 2.13.3 Informational/Error Messages

The following messages may be output to the printer by the task under the described condition:

#### a. 'NO LEAD CARD - NC. HOURS TO SLIDE COL. 3-4'

An EOF was detected where the lead card should be. The task must have a lead card. No changes have been made to any data base.

#### b. 'NO. HOURS TO SLIDE INVALID - 1 THROUGH 84 VALID'

The number of hours to slide the data was negative, zero, or greater than 84. The number must be a positive integer;

therefore, the start of data time will always be later. If it is desired to slide the data more than 84 hours, the task will have to be executed more than once. No changes have been made to any data base.

C. 'LOW AND MEDIUM RATE DATA SLID X HOURS'

Where X is the number of hours the data was slid. It should equal the lead card input. This is normal termination message when task is complete.

The new start of accepting data is also printed and should be verified.

ORIGINAL PAGE IS  
OF POOR QUALITY

## 2.14 ARCHIVING OF MISSION DATA

At the end of each mission it is necessary to archive certain data acquired during the mission for use as past mission data during future missions. The data values archived are in engineering units. The data archived is the Current Mission Low/Medium Rate data base and up to 2 hours of high-rate data. The high-rate data consists of up to 150 parameters and not over 12 time segments of 10 minutes each. If a time segment over 10 minutes is desired, then a segment for each 10 minute interval or portion thereof is required.

The data is written to tape and should be held in permanent storage until released by the SMD. Multiple copies of the tape should be maintained since it would be very difficult to regenerate the data on the tape. The tape is in a format acceptable by the loading predicted/past mission data base task.

### 2.14.1 Input

The input to this task is a card deck and data bases with all desired data already on disk. There are three different type cards required as input but only the first card is required if only the current mission low/medium rate data is to be archived on that specific computer run. The format of the input cards is as follows:

			ORIGINAL PAGE IS OF POOR QUALITY
<u>Card</u>	<u>Card column</u>	<u>Description</u>	
1	1-4	Data base rate to archive If = LOW or MED - Archive current mission low/medium rate data base. Left-justify parameter in field. If = HIGH - Archive high-rate data only.	
	5-8	Next data to archive If = HIGH - Archive high-rate data after low/medium rate data has been archived.	

Card 1 is required.

Cards 2, 3, and 4 are necessary for archiving high-rate data. Times must be in a mission-elapsed time from the start of data time in the MSFD data base.

ORIGINAL PAGE IS  
OF POOR QUALITY

<u>Card</u>	<u>Card column</u>	<u>Description</u>
2 - 4	1-4	Hour to start archival of 1st segment
	5-8	Minute to start archival of 1st segment
	9-12	Second to start archival of 1st segment
	13-16	Time interval for 1st segment (minutes)
	17-20	Hour to start archival of 2nd segment
	21-24	Minute to start archival of 2nd segment
	25-28	Second to start archival of 2nd segment
	29-32	Time interval for 2nd segment (minutes)
	33-36	Hour to start archival of 3rd segment
	37-40	Minute to start archival of 3rd segment
	41-44	Second to start archival of 3rd segment
	45-48	Time interval for 3rd segment (minutes)
	49-52	Hour to start archival of 4th segment
	53-56	Minute to start archival of 4th segment
	57-60	Second to start archival of 4th segment
	61-64	Time interval for 4th segment (minutes)

Cards 3 and 4 are the same format except archival time is for segments 5 through 12. These 3 cards are required although there may not be 12 segments due to the time interval for some of the segments.

Cards 5 through N are necessary for archiving high-rate data. The parameter names must be the same as in the MSID data base.

<u>Card</u>	<u>Card column</u>	<u>Description</u>
5 - N	1-8	Parameter name of 1st parameter to archive
	26-33	Parameter name of 2nd parameter to archive
	51-58	Parameter name of 3rd parameter to archive
	76-80	Card sequence number

Cards 6 through N are same format as card 5 except they contain parameter names for the 4th through 150th parameters to archive.

If a field (parameter name) is left blank, that position is not counted as one of the 150 parameters. Card sequence number is not checked but printed, if an error is detected in the card.



An EOF card anytime after card 5 will terminate the number of parameters to be archived.

All the desired data is assumed to be in the respective data bases upon execution of this task. The following data bases are required for archival of the low/medium rate data:

- a. MSID
- b. Data Directory
- c. Current mission low/medium rate

The data bases required for archival of the high-rate data are the following:

- a. MSID
- b. Data Directory
- c. CDB
- d. Working File
- e. Predicted mission high-rate used as a scratch file in processing
- f. Past mission high-rate used as a scratch file in processing

The predicted and past mission high-rate data base are written to and read from in processing the high-rate data; therefore, these data bases will be destroyed. The data for all desired CDS's must be in the working file before the task is begun.

#### 2.14.2 Processing

The high-rate data requires a certain amount of processing before the data is archived but the low/medium rate data is just a copy from disk to tape. The basic processing required in the high-rate data is to: (1) select data for only the desired parameters, (2) select data for only the desired times, (3) sort the data by parameter, and (4) calibrate data for each parameter with its calibration coefficients. Data values are from a data cycle based on start of data time in the MSID data base and the data cycle time. If no valid data value is found for a specific time within a desired segment for any parameter, the value for that slot will be a fill pattern. A valid data value is one that was in a minor frame acceptable by the NIP. Redundant data values for a time slot are overstored. Only the last valid data value based on start times in a CDS are saved.

### 2.14.3 Output

The output of this task is a tape containing four files of data if low/medium and high-rate data are archived. Each tape file contains a header record and multiple data records. The tape file description of data records is as follows:

<u>File no.</u>	<u>Max. no. record</u>	<u>No. 32-bit words/record</u>	<u>Description</u>
1	7	2688	Data Directory data base
2	740	1344	Low-rate data
3	120	2688	Medium-rate data
4	450	2688	High-rate data

The header record contains mission ID information from the MSID data base and tape file ID. For the low- and medium-rate data files, the record also contains the parameter names for the data contained within that file from the MSID data base. For the high-rate data file, the record contains the parameter names input and the requested time intervals in integer seconds.

The Data Directory data base is not output if only high-rate data is processed.

Only error-free tapes should be used for output in this task because the tape will be required in future missions as input.

### 2.14.4 Informational/Error Messages

The following informational or error messages may be output to the printer during execution of the task:

a. 'NO LEAD CARD - MUST HAVE ONE'

ORIGINAL PAGE IS  
OF POOR QUALITY

An EOF was detected where the first lead card should be or the data base rate to archive is invalid.

b. 'LOW AND MEDIUM RATE DATA ARCHIVED'

The first three files of the output tape have been written. Normal termination if no high-rate data to be archived.

c. 'EOF READING HIGH-RATE TIME INTERVALS'

An EOF was detected before three time cards for archival of high-rate data - task terminated.

d. 'TOO MANY TIME INTERVALS OR TOO MUCH TIME'

The time intervals requested compute to too many 10-minute intervals - task terminated.

e. 'TOO MANY MEASUREMENTS'

More than 150 parameter names were read before an EOF detected - task terminated.

f. 'MEASUREMENT X NOT FOUND - SEQ Y'

Where X equals parameter name and Y equals card sequence number. The parameter name was not found in the MSID data base. The remainder of the input deck will be searched for error.

g. 'ABOVE MEASUREMENTS NOT FOUND - JOB TERMINATED'

At least one parameter name was not found in the MSID data base. The parameter name(s) and card sequence number(s) have already been printed - task terminated.

h. 'NO DATA FOUND ONLINE FOR A INTERVAL - TERMINATED'

No data was found in the working file for one of the time intervals requested; therefore, task terminated. All the data desired for high-rate archival must be in the working file before the task is started. Every requested interval must have some data.

i. 'TOO MANY CDS'S FOR INTERVAL - CALL PROGRAMMER'

More than 25 CDS's were found with data in the working file for a 10-minute data segment. This is a program limitation and requires a program change, if the data must be processed. The task is terminated.

j. 'CDS'S NOT IN WORKING FILE THEREFORE NOT USED

CDS	GMT	INTV	TAPE
-----	-----	------	------

This is a list of the CDS's in the data directory but the data was not in the working file for each 10-minute interval of requested data. Not a fatal error but the task will have to be rerun if the data should have been in the working file.

k. 'X HIGH RATE PARAMETERS ARCHIVED'

Where X equals the number of parameters. A count of the numbers of high-rate parameters archived. Normal termination after the high-rate data has been written to tape.

## 2.15 DUMPING OF TAPE OR DISK DATA

During program checkout it often became necessary to dump information from tape or disk to verify data and format. Two programs were developed for this task. One program TAPD dumps data from tape and the other program DSKD dumps data from disk. The programs are quite flexible; therefore, lead cards are required as input. The programs will probably be useful during a mission, if it becomes necessary to verify parts of a data base.

### 2.15.1 Input

These programs require a lead card for each tape or disk file that data is required. More than one lead card may be required per file if different data output formats are required or different parts of a record required. A record from the disk is considered a track.

The format of the card required for dumping tape is as follows:

<u>Card column</u>	<u>Description</u>
2-5	File number to process
7-10	Record number of file to begin if not 1st record
12-15	Word number of record to begin if not 1st word
17-20	Number of records to process in file
22-25	Record increment if not equal to 1
27-30	Number of words/record to process
32-35	Word size if not equal to 16 bits 32 is only other acceptable word size
39-40	Format to output words to printer 'A' = ASCII 'H' = Hexadecimal 'E' = E format (32-bit words only) 'I' = Integer format 'DD' = Data Directory File - Print by preset format
43-45	If = YES - Print information in header record (fixed format) This option only applicable if processing a predicted or past mission tape

ORIGINAL PAGE IS  
OF POOR QUALITY

The other input required for the tape dump is a tape and the computer operator specifies the unit number.

The format of the card required for dumping disk is as follows:

<u>Card column</u>	<u>Description</u>
2-5	Disk file number to process
7-10	Track number of file to begin 0 is 1st track of a file
12-15	Sector number of track to begin 0 is 1st sector of a track
17-20	Number of tracks to process
22-25	Track increment if not equal to 1
27-30	Number of words/track to process
32-35	Word size if not equal to 16 bits 32 is only other acceptable word size
39-40	Format to output words to printer 'A' = ASCII 'H' = Hexadecimal 'E' = E Format (32-bit words only) 'I' = Integer format 'DD' = Data Directory File - Print by preset format

ORIGINAL PAGE IS  
OF POOR QUALITY

The other output required for the disk dump program is assumed to be in the specified file of the mounted disk. One card is required for each file or segment of input source. An EOF card terminates the processing.

## 2.15.2 Output

The output of this task is a printer listing of the desired data. The information from each input card is printed before the data requested in that card. Each record's dump is preceded by identification information. The number of words printed per line, dependent on the format is as follows:

<u>Format</u>	<u>Word size (bits)</u>	<u>No. words/line output</u>
A	16	40
A	32	24
H	16	24
H	32	12
E	32	8
I	16	20
I	32	10

A word count is the first field of each line printed.

### 2.15.3 Informational/Error Messages

One or more of the following messages may be output by TAPD or DSKD:

a. 'INVALID FORMAT'

The format to output words to printer is unacceptable - not an 'A', 'H', 'E', 'I', or 'DD'.

b. 'TOO MANY WORDS/RECORD COMPUTED'

The number of words/record greater than 5376 16-bit words. This is computed by the word number to begin and the number of words to dump.

c. 'INVALID WORD SIZE FOR E FORMAT'

The output was requested in the 'E' format but the word size was not 32 bits.

d. 'ALL REQUEST PROCESSED'

An EOF card was detected when reading a data card - normal termination.

One or more of the following messages may be output by TAPD only:

a. 'UNRECOVERABLE ERROR ON TAPE READ'

Fatal error from tape unit - task terminated.

b. 'EOF DETECTED AS 1ST RECORD OF FILE'

The first record of the requested tape file was an end-of-file mark - task terminated.

c. 'NO ATTEMPT TO PRINT HEADER - NOT AT 1ST RECORD'

It was requested that the header record be printed but not to start the dumping at record 1. The print header request is ignored and the requested records are processed.

d. 'PARITY FILE X RECORD Y'

Where X is tape file number and Y is the record number of the file. No processing of record attempted but program continues as if it were processed.

One or more of the following messages may be output by DSKD only:

a. 'INVALID FILE NUMBER'

The disk file number requested to be processed was either less than 1 or greater than 64. Program reads next card.

b. 'SPAN TRACKS USING SECTOR AND NO. WORDS'

No provisions are made in the program to span track boundaries in processing a record. Program ignores this request and goes to next.

ORIGINAL PAGE IS  
OF POOR QUALITY

### 3.0 INITIAL LOADING OF DATA BASES

Most of the data bases must be loaded or initialized before the processing of any data can begin. The following is a list of the data bases, a suggested order for loading, and the task name that loads them.

<u>Order</u>	<u>Data base</u>	<u>Task name</u>
1	MSID	MSID
2	Support Tables	STDBMP
3	Calibration	BLDCDB
4	High-Rate Load Groups	HRLG
5	Display Formats	PREGRP
6	Predicted Mission	PRCV & LDPP
7	Past Mission	ARCH & LDPP
8	Data Directory (Initialize)	INIT
9	Current Mission Low/Medium (Initialize)	INIT

The MSID data base must be loaded first since parameter position in it fixes parameter position or pointers for all other data bases. If the MSID data base is changed, the other data bases must be reloaded. The actual loading order of data bases 2 through 9 is immaterial. These data bases may be reinitialized or updated during a mission by the same task.

The following data bases are updated by data received from a NIP CCT or from the terminal during a mission:

<u>Data base</u>	<u>Task name</u>
Working File	NIPP, RES, LDH
Data Directory	DDUP
Current Mission Low/Medium Rate	LMUP
Current Mission High-Rate	HRUP
Display Formats	OFD

The request for current mission high-rate data comes from the user via his interactive terminal. The display formats may be updated by the user via his interactive terminal. The terminal's Current Mission High-Rate and Display Formats data bases are the only data bases that may be updated via commands from a user terminal.

ORIGINAL PAGE IS  
OF POOR QUALITY



#### 4.0 PROCEDURE FOR RELOADING AFTER SYSTEM FAILURE

Most system software crashes will probably not affect data bases on disk therefore it will not be necessary to reload data bases but just to re-boot the system. If the system was processing a NIP CCT when failure occurred, that task will have to be restarted. After the system is back up and running, the data manager should verify with the user that his data is all right. It may be necessary to re-establish data bases after a system failure if data problems appear after the re-boot. Disk crashes or disk reconfiguration require that the data bases be re-established. The following procedure should be followed in re-establishing the data bases.

- a. Obtain the last Save tape defined in section 2.11 and reload this tape by the task defined in section 2.12. If there were errors with the tape during reloading, see section 2.12 for explanation of corrections to be made. This re-establishes the data bases defined in section 2.12 to the status they were when the save tape was made. It also sets flags in each data directory entry to indicate no data is in the working file.
- b. Obtain the desired predicted mission data tape and reload the predicted mission data base by the task defined in section 2.6.
- c. Obtain the desired past mission data tape and reload the past mission data base by the task defined in section 2.6.
- d. Get the TMS intermediate tapes for all the NIP tapes that have been processed since the Save tape was made. Restore each tape to the working file, in the order they were initially processed, by the restore task defined in section 2.8. This task will overlay the low/medium rate update and the data directory update task after each tape is restored to the working file.

At this point the Current Mission Low/Medium Rate data base and the data directory are restored to the condition they were when the crash occurred. All other data bases are restored to the status they were when the Save tape was made. If updates were made to any of these data bases after the Save tape was made, the task that last updated the data base must be rerun. The display formats data base may have been updated from the user terminal. These updates will have to be remade by the user or the updates must be punched into cards and the task defined in section 2.3 executed.

The same procedure should be followed if a data disk is lost during a mission.

If the TMS computer is going to be down for an extended period of time, it is possible to switch to the STCS computer. Reference 7 contains the procedure to switch computers after approval is received.

ORIGINAL PAGE IS  
OF POOR QUALITY

## REFERENCES

1. TMS User's Guide, JSC-14811.
2. GDSD/IDSD Interface Control Document for Orbital Flight Test (OFT).
3. OFT Interface Control Document for STCS/IES CCT. LEC-11402.
4. Shuttle Orbital Flight Test Calibration Data Plan. SD 76-H-0102A.
5. Detailed Requirements Document for the MMDB System, Vol. 1, JSC-11731.
6. TMS Program Design Workbook.
7. TMS Operator's Guide, JSC-14810.

ORIGINAL PAGE IS  
OF POOR QUALITY

TECH PUBS	
FINAL	
ed.	<u>B. J.</u>
date	<u>5/21/79</u>